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HELY (P. C.) & WASON (E. J.). **Control of Red Scale on *Citrus*. Experiments on the Murrumbidgee Irrigation Area.**—*Agric. Gaz. N.S.W.* **56** pt. 6 pp. 262–267, 3 figs., 2 refs. Sydney, 1945.

Details are given of experiments in 1940–43 to determine the best programme of fumigation with hydrocyanic acid gas, spraying with white oil, or both against the red scale [*Aonidiella aurantii*, Mask.] on *Citrus* in the Murrumbidgee Irrigation Area, New South Wales [*cf. R.A.E.*, A **29** 336], where the scale develops rapidly during summer and autumn and control must be very efficient.

Two experiments (A and B) were begun in 1940 on Valencia orange trees infested with 14·48–18·63 and 15·67–20·02 living scales per leaf, respectively, in January; 12 trees were used in each, and each comprised six programmes applied to groups of two trees. Fumigation was done at the standard rate with Calcid briquettes and liquid HCN, one briquette being considered equal to 14 cc., and white oil was applied at full and half strength (1 : 40 and 1 : 80). The fruits were classified into three grades of scale infestation at harvest, and a control index was calculated for each treatment. In experiment A, these indexes were: 99·22 for single applications of oil (1 : 80) in January and February and fumigation in March; 98·66 for oil (1 : 40) followed by fumigation, both in February; 97·53 for oil (1 : 80) in January and fumigation in March; 97·33 for fumigation followed by oil (1 : 40) in February; 97·62 for oil (1 : 40) in January followed by fumigation in February; and 95·39 for fumigation at double strength in February. In experiment B, they were: 92·58 for two sprays of oil (1 : 80) in February and one in March; 92·92 for two sprays (1 : 80) in January and two in March; 90·6 for one spray (1 : 80) in January, February and March; 94·14 for the last schedule with the oil at full strength in March; 90·54 for one spray (1 : 40) in January and March; and 93·67 for fumigation only in February. An almost immediate improvement in the appearance of the trees was evident, particularly where oil had been applied, and they were covered with luxuriant foliage after twelve months. In September, the numbers of scales still on the foliage were much greater for the treatments that did not include oil, and the effect of oil in aiding the shedding of dead scales was also apparent on the fruit at harvest, particularly where the spray had been applied before fumigation. The best results were given by schedules that included both fumigation and spraying; these gave the highest mortality and also resulted in the shedding of dead scales. The small proportion of living scales on the trees that received half-strength oil in January and February and fumigation in March indicated that the initial scale population had been prevented from increasing. There was little difference between fumigation only and spraying only in the proportion of clean fruit harvested, but a much greater subsequent infestation developed on the sprayed trees. Increasing the number of applications appeared to allow of a reduction in the total quantity of oil applied; the oil sprays were less effective in January than in February or March, and shortening the intervals between treatments increased their effectiveness. No differences in size, colour or quality of fruit were observed in experiment A, except that the skin quality was less attractive in fruit that received no oil spray, but in experiment B, fumigated fruits had a better colour than most of those that received multiple oil sprays and appeared superior in internal quality. Comparison of briquette and liquid methods of fumigation showed in all but one case a slight but consistent difference in favour of the latter. Estimation of the amount of blossom in the spring of 1940 and of fruit harvested in 1941 showed no significant differences that could be related to the treatments in experiment A; in experiment B, fumigated trees yielded nearly twice as much fruit as the best of the sprayed ones, and trees that had received four applications of half-strength oil gave the lowest yields; reduction in yield tended to be greatest where the greater quantities of oil were applied, particularly later in the season.

In 1941, one of each pair of trees in experiment A was left untreated and the other fumigated with calcid briquettes at the standard rate in January, and the control indexes were 85·14–98·24 for the untreated trees and 99·78–100 for the fumigated ones. One of each pair in experiment B was sprayed once with oil (1 : 40) and the other twice with oil (1 : 80) except in the case of the fumigated trees, in which the second was fumigated again. The control indexes were 88·74–94·39 for the one spray 93·62–97·13 for the two, and 99·82 for the fumigation. The results showed that the combination of spraying and fumigation in one season will generally ensure that both trees and crop will be substantially free of scale in the following season, even when no further treatment is applied and trees were originally heavily infested, and that such combined treatments are generally superior to a single fumigation at double dosage ; where either the combined treatment or fumigation at double dosage is followed by a standard fumigation in the second season, a very high degree of freedom from scale is ensured. Two sprays of oil (1 : 80) in January and February followed by fumigation in March proved very effective when considered over a two-year period ; a single spray of oil (1 : 40) in January followed by fumigation in March was also satisfactory. There appeared to be no difference in control whether the spray or the fumigant was applied first. In experiment B, two sprays of oil (1 : 80) resulted in much greater freedom from scale on both fruit and leaves than a single one at full strength. The best treatment was fumigation, particularly when it was repeated in the second season. When fumigation was replaced in the second season by a single oil spray the results were less satisfactory than in some cases in experiment A in which no treatment was given in the second season. Counts of blossom in the spring of 1941 and of fruit at harvest in 1942 showed that the blossom-reducing effects of the multiple oil sprays applied in 1940 were not apparent in the following season, and there was no difference in the effect of a single full-strength oil spray and two half-strength ones.

In 1942, all trees in experiment A that had been treated in two consecutive seasons were left untreated, two that had received one oil spray (1 : 80) in January or two in January and February 1940, followed in each case by fumigation in March and no further treatment were again left untreated and the remainder were fumigated with Cyanogas calcium cyanide at the standard dosage. In experiment B, all but two trees were fumigated. It was found that though scale increase was considerable on some of the trees not treated in 1942, the residual value of the treatments in the previous seasons was quite high. Where no treatment had been applied since 1940 there was appreciable control, particularly when the 1940 schedule included two half-strength sprays followed by fumigation, but it was apparent that trees originally so heavily infested should not be left without further treatment for more than two seasons. In experiment B, trees treated in each of the three seasons yielded a high proportion of uninfested fruit, particularly when two sprays at half strength had been applied in 1941 ; a tree that had received oil sprays in the first two seasons and no treatment in 1942 showed a considerable increase in infestation, but better results were given by fumigation in 1940 and 1941 and no treatment in 1942.

The authors conclude that, for heavily infested trees, the primary objective should be to reduce the infestation to the lowest possible point in the shortest time, sufficiently early in the season to allow of maximum shedding of dead scales from the fruit before harvest ; treatment too early may permit an increase of the scale during autumn, so that the advantage gained by early treatment is lost. Fumigation should be the principal means of control, and should preferably be carried out in the second half of February, but unless the trees can be fumigated twice during the same season, the greatest amount of clean fruit will not be produced at harvest, as much of it will be infested by February and will not shed the dead scales effectively after fumigation.

Spraying with oil to prevent infestation until fumigation can be performed in February is a satisfactory supplementary measure, the optimum time for it being about two weeks before fumigation. It is less effective as a substitute for fumigation, as the number of applications required for comparable control have deleterious effects on both trees and fruit. Single summer applications of white oil (1 : 40) or double applications at half strength are not injurious, but any increase over this amount may be followed by ill effects, including poor coloration of the fruit, variable size, coarsening of the rind, reduced juice content and a lower ratio of solids to acids in the juice, with a reduction in crop in the season following application. Judicious applications of oil stimulate foliage growth and have a refining effect on the rind of *Citrus* fruits.

GRAVELY (F. H.). **Paraffin Wax as a Protection against Termites.**—*J. Bombay nat. Hist. Soc.* **45** no. 3 pp. 439–440. Bombay, 1945.

In a camp on heavily infested ground in Madras, ground-sheets of unbleached calico impregnated with paraffin wax protected everything on them from attack by termites throughout the night, whereas the blankets and, in some cases, pyjamas of men who did not use such ground-sheets were badly damaged. In consequence of this result, a coating of paraffin wax was applied to the insides of all book-cases in a library in which most of the shelves were built into the walls and termites were a constant cause of injury to the books. This resulted in a great improvement, though termites quickly made their way through any small gaps that had been left. When these were found and filled, the books were completely protected, and they have remained free from injury for a number of years.

HAYWARD (K. J.). **Modelo de jaula que permite la distribución de parásitos dentro de las pupas de sus huéspedes.** [A Design for a Cage that permits the Distribution of Parasites in the Pupae of their Hosts.]—*Rev. industr. agric. Tucumán* **34** no. 1–3 pp. 23–26, 2 figs. Tucumán, 1944.

One of the methods of control used against the fruit-fly, *Anastrepha fraterculus*, Wied., in the Province of Tucumán, Argentina, is the liberation of parasites in infested orchards [*cf. R.A.E.*, A **33** 134]. For that purpose, the author devised a wooden cage that would accommodate parasitised puparia of *Anastrepha* and was provided with an exit covered with wire gauze through which the parasites could escape. The perforations of the gauze had a diameter of 1·8 mm., which was thought small enough to retain any fruit-flies that emerged from the material. About a million puparia parasitised by various Hymenoptera have been distributed in this way since 1940, and on receipt the cages are hung up in infested orchards until the parasites have emerged. It appeared in the course of the work, however, that newly emerged fruit-flies, the integument of which had not yet hardened, were able to squeeze through gauze of the mesh employed, while the largest of the parasites could escape through perforations 1·65 mm. in diameter. The cage, which is described and illustrated, was modified accordingly.

Service and Regulatory Announcements, October-December 1945.—*S.R.A., B.E.P.Q.* no. 165 pp. 51–89. Washington, D.C., U.S. Dep. Agric., 1946.

An Announcement relating to the Nursery Stock, Plant and Seed Quarantine (no. 37), effective 8th October 1945, prohibits the entry into the United States of the seed of okra (*Hibiscus esculentus*), including that in dried seed-pods, except under permit and subject to inspection. The measure is designed to prevent the introduction of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., which sometimes infests the seed [*cf. R.A.E.*, A **32** 57] and is at present established in only a limited area of the United States.

Other information in this part includes a revised supplement to plant-quarantine import restrictions in the Union of South Africa [**28** 611], a supplement to restrictions in Brazil [**24** 259], a revised digest of restrictions in Dominica [**24** 803], and summaries of the current domestic and foreign quarantines applying to the United States and the Territories of Hawaii and Porto Rico, and of other restrictive orders under the Plant Quarantine Act [**17** 163].

RITCHER (P. O.). **Control of the Strawberry Crown Borer by Methyl Bromide Fumigation and with Poison Baits.**—*Bull. Ky agric. Exp. Sta.* no. 468, 28 pp., 10 figs., 28 refs. Lexington, Ky., 1944.

An account is given of experiments in Kentucky in 1940–43, the earlier of which have already been noticed [*R.A.E.*, A **29** 554], from which it is concluded that all eggs, larvae and adults of *Tyloderma fragariae*, Ril., in strawberry plants dug for setting out in new plantations can be destroyed by subjecting the plants to fumigation with methyl bromide at a dosage of 3 lb. per 1,000 cu. ft. for two hours at atmospheric pressure and at chamber temperatures within the range of 65–83°F. and load temperatures of 65–75°F. This treatment caused no injury to plants of various varieties, and in a field trial on a commercial scale in 1942, no difference was observed in the subsequent growth and yield of treated and untreated plants.

In further small-scale field trials of the proprietary bait of dried chopped apple refuse coated with 3·5 per cent. sodium fluosilicate [*cf.* **29** 362] in August 1940, 76·9–88·9 per cent. mortality of the adults was obtained. In a field trial in 1941 in which eight applications were made between 11th April and 25th June to parts of a plot and adult weevils released at or near the edges, infestation was reduced by 81·5–84·3 per cent. in the baited areas. The reduction was not so great in the middle of the plot, which was left unbaited but was surrounded by baited areas, and it is concluded that although the application of bait to eight or ten rows round the outside of a patch affords considerable protection, it will not entirely prevent infestation. Baits prepared from dried chopped apple pomace with 3·5 per cent. lead arsenate or sodium fluosilicate gave 96 and 92 per cent. mortality of the adults, respectively, in laboratory tests, and the lead-arsenate bait gave 89·2 per cent. mortality in 1941 in a field test in which the commercial bait gave 75·4 per cent. The bait was ineffective when prepared from sour apple pomace. When the proprietary bait was placed round potted plants of *Potentilla canadensis*, which is common on many farms in Kentucky and provides a source of infestation for strawberry plants, a mortality of 72 per cent. was obtained. Poison baits should be applied in all cases where fumigated plants cannot be set at a distance of at least 350 yards from patches of *P. canadensis* or from wild or infested strawberry plants.

ZELLER (S. M.) & SCHUH (J.). **Diseases and Insect Pests of Cane Fruits in Oregon.** —*Bull. Ore. agric. Exp. Sta.* no. 418, 58 pp., 27 figs. Corvallis, Ore., 1944.

Almost half this bulletin comprises notes on the appearance, bionomics and control of some 30 insects and two mites that attack raspberries, blackberries and allied fruits in Oregon. A table, showing the sort of injury caused by the various pests, the season at which it occurs, the recommended control measures and the time at which they should be applied, is appended.

BALDUF (W. V.). **Bionomics of the Rose Seed Chalcid, *Megastigmus nigrovariegatus*, Ashm. (Hymenoptera, Callimomidae).**—*Proc. ent. Soc. Wash.* **47** no. 7 pp. 185–198, 5 refs. Washington, D.C., 1945.

The observations here recorded on the life-history of *Megastigmus nigrovariegatus*, Ashm., were made in Illinois in 1942–44. This Torymid is restricted to the seeds of wild and cultivated roses, and 8 of 12 species were found to be

attacked, the percentage infestation of the achenes being greatest in *Rosa virginiana*, *R. palustris* and *R. rugosa* (67·96, 57·54 and 53·67, respectively). Susceptibility to attack appears to depend on the date of flowering and formation of the hips, the diameter of the hip, the thickness and toughness of the receptacle and pericarp, and the size of the seeds. There was only one generation a year. The larvae overwintered within the achenes in which they had developed, pupated in late April and early May and gave rise to adults from the last week of May until 20th June, though pupal development was delayed in a few cases. The first males emerged 1–3 days before the females, and males represented 47·53 per cent. of nearly 800 adults examined. Pairing occurred as soon as the females emerged from the hips, and eggs were laid soon after on or within the testa of the seed, about 95 per cent. being deposited in the achenes nearest to the receptacle and the rest in those in the central part of the hip. The larvae feed on the seeds, only one developing in each achene. The larvae were first found in mid-June, 11–12 days after the first eggs were deposited, became full-grown about the end of July, and remained dormant in the seed cavity until the following spring. Larvae of *Rhynchites bicolor*, F., which feed on the achenes, probably consume the larvae of *Megastigmus* in so doing, and one nymph of *Sinea diadema*, F., was observed attacking an adult; some of the larvae were infested by a fungus, but failure of the seeds to develop was responsible for higher mortality than any natural enemy.

Entomology.—*Rep. nat. agric. Res. Bur. China 1932–44* [pp. 23–27] multigraph. Peipeh, Szechuan [? 1945].

Investigations in China in 1934–37 showed that the breeding grounds of the migratory locust [*Locusta migratoria manilensis*, Meyen] occur chiefly on the sea coast and lake shores and on swamp and alkaline soils, which are common in the lower Yellow River Valley and regions north of the lower Yangtze River. Migration occurs over the whole of these regions, but appears to be stopped by the mountains west of Hopei and Honan and south of Anhwei and Chekiang. Work on the moth borers infesting rice, which has been in progress since 1933 [*cf. R.A.E.*, A **25** 231; **27** 613; **34** 152] has shown that the most effective method of control is to burn the infested stubble or to bury it and cover it with a winter-growing cover crop. Other measures that reduce infestation are collecting and destroying the egg-masses and setting tobacco stems in infested fields in late summer and autumn. Late varieties are stated to suffer more damage than earlier ones [but *cf.* **34** 153]. Control measures carried out over an area of about 670,000 acres in the provinces of Kiangsu, Chekiang, Hunan and Szechuan have resulted in an increase in rice production of 11 million bushels. Treatments recommended against cotton pests include spraying with tobacco extract or vegetable-oil emulsion against the cotton aphis [*Aphis gossypii*, Glov.] [*cf.* **24** 325], thin flour paste or vegetable-oil emulsion against the red spider [*Tetranychus*], lead or calcium arsenate against the cotton leaf-roller [*Sylepta derogata*, F.] and lime-sulphur or Bordeaux mixture against Jassids. About 500,000 acres of cotton have been treated, with an accumulated increase in production of more than 20,000 tons of seed cotton.

KAPUR (A. P.). **Combined spraying Trials against the San José Scale and Peach Leaf-curl in Kashmir.**—*Bull. ent. Res.* **37** pt. 1 pp. 29–32, 18 refs. London, 1946.

Peach trees in Kashmir are attacked by *Quadraspidiotus perniciosus*, Comst., which is sometimes so numerous as to destroy young unsprayed trees in two seasons, and the fungus, *Taphrina deformans*, which causes leaf curl, as a result of which up to 70 per cent. of the leaves may drop prematurely. The

Coccid is often controlled by a winter spray of diesel oil emulsified with soap, but this is of no value against the fungus, and experiments were accordingly made in 1942–44 on combined sprays of oil emulsified with Bordeaux mixture, previous work on which is reviewed from the literature. Preliminary field trials in 1942–43 showed that diesel oil, the specifications of which are given, could be substituted for the lubricating oils used elsewhere, provided that the Bordeaux mixture was freshly prepared. In a further experiment in the early spring of 1944, the percentage control of the Coccid and (in brackets) the percentage of leaves curled by the fungus were 100 (12·1) for a boiled emulsion containing 2 gals. diesel oil, 1 lb. soft soap and 1 gal. water, diluted in 10 parts water to give nearly 6 per cent. actual oil content; 88·9 (5·1) for this spray when it was applied 5 days after Bordeaux mixture (5 : 5 : 50); 73·7 (6·1) for the same stock emulsion in 10 parts Bordeaux mixture (5 : 5 : 50); 100 (5) for a cold-mixed emulsion of diesel oil and Bordeaux mixture (4 : 4 : 50) prepared by adding copper sulphate and lime to 2 gals. oil and 1 gal. water and diluting with 10 parts water; and 16·6 (4·6) for Bordeaux mixture (5 : 5 : 50) alone; as compared with 0 (32) for no treatment. It was thus evident that there was a reduction in control of the Coccid when Bordeaux mixture was mixed with or applied before the soap emulsion, which may have been due to its absorbing some of the oil [*cf. R.A.E.*, A **18** 472], whereas there was none when it was used as the emulsifier; the amounts of copper sulphate and lime were then smaller, but this reduction was not sufficient to account for the difference. The emulsion formed with Bordeaux mixture is quick-breaking, whereas that formed with soap is more stable, and it is concluded that this advantage offsets any possible absorptive properties of the Bordeaux mixture. The combined spray did not injure the trees when it was properly prepared.

NOTLEY (F. B.). **Tests on Locust Baits in Somalia.**—*Bull. ent. Res.* **37** pt. 1 pp. 89–94. London, 1946.

Wheat bran is the most widely-used carrier for poison baits against locusts, but is difficult to obtain in quantity in East Africa. Coffee parchment, with the addition of molasses, has been successfully used in Kenya since 1931 [*cf. R.A.E.*, A **20** 68; **22** 10], and it was also used during the heavy outbreak of *Schistocerca gregaria*, Forsk., in Somalia in 1943–44, but as this involved its importation in large quantities from Kenya, tests were made to discover suitable substitutes available locally. In preliminary cage experiments in the autumn of 1943, in which adults that had not been fed for at least a day were offered a choice of two moistened unpoisoned baits, wheat bran and rice bran were the most attractive materials, and bagasse, of which large quantities are readily available, used alone or with molasses, and maize-cob refuse, of which smaller quantities are available, were as attractive as coffee parchment with molasses. The other materials tested were coffee parchment alone, jute, rice grits, rice husks, sawdust and ground-nut shells, all of which were either less attractive or of greater value for other purposes. In similar tests with hoppers, which appeared in numbers in December, the order of preference for the materials tested was found to be wheat bran with or without molasses, maize-cob refuse with molasses, rice bran, maize-cob refuse alone, bagasse with molasses, coffee parchment with molasses, bagasse alone, sawdust with molasses, coffee parchment alone, rice husks, and sawdust alone. The amount of water that can be absorbed by a bait and the period for which it is retained are of importance in dry countries, where water is a strong attractant; the amounts absorbed by 5 gm. bagasse, wheat bran, sawdust, maize-cob refuse, rice bran and coffee parchment were found to be 20, 12, 12, 10, 8 and 6 gm., respectively. In November 1944, cage tests were carried out with stalks of maize and sorghum, and the former were found to be as attractive as bagasse

and the latter slightly but significantly more so. Sorghum stalks also gave satisfactory results in small-scale field tests, but are more difficult and expensive to collect and prepare than bagasse.

Experimental applications of bait in which bagasse was the carrier were made during the short-rains campaign between November 1943 and January 1944 and the long-rains campaign in May–July 1944, and it was used on a large scale between November 1944 and January 1945. In a typical experiment, the hoppers began to feed on the bait as soon as it was distributed, all those examined 12 hours later had fed on it, and mortality after a further 12 hours was about 65 per cent. Good results were obtained everywhere, even among thick grass and in moist places, and the bait was more attractive than the coffee-parchment bait or local vegetation, remained attractive longer than the coffee-parchment bait, and was more easily handled, distributed and stored. A further advantage of bagasse as a carrier is its lightness. It was found that an effective bait was produced by using sodium arsenite at a rate of only ½ lb. and molasses at the rate of 2 pints per bag (33 lb.). The methods of drying and grinding bagasse for use in bait and of preparing the bait are described, and the cost is discussed.

SIMMONDS (F. J.). **A Factor affecting Diapause in Hymenopterous Parasites.**—*Bull. ent. Res.* **37** pt. 1 pp. 95–97. London, 1946.

During studies in North America on the bionomics of *Spalangia drosophilae*, Ashm., which parasitises the puparia of *Oscinella frit*, L., it was observed that diapause of the full-fed larvae was favoured not only by development at low temperatures, as in many other species, but also by other factors, since individual females reared and allowed to oviposit under identical conditions gave rise to progeny, some, all or none of which entered diapause. These differences did not appear to be inheritable. In an experiment in which females oviposited at a constant temperature of 75°F., some produced offspring of which a number entered diapause when fully grown, and it was noticed that most of these developed from eggs laid towards the end of the oviposition period. A similar effect was later observed in an undescribed species of *Cryptus* that lives as an ectoparasite on the larvae of *Loxostege sticticalis*, L., in their cocoons. Observations on the progeny of typical single mated and unmated females of each of these species are shown in a table. Both the females of *S. drosophilae* oviposited over a period of about 40 days. Few or none of the larvae that hatched from eggs laid during the first five days went into diapause, but the proportion to do so increased as oviposition progressed and all of nearly 200 that hatched from eggs deposited 16 or more days after emergence did so, with the exception of one from an egg laid by the fertilised female after 21 days and three from eggs laid by the unmated female after 23–24 days. The duration of development of the larvae that did not enter diapause increased with the age of the parent female. None of the larvae from eggs laid by the females of *Cryptus* in the first five days went into diapause. The fertilised female laid viable eggs for 22 days, and the highest proportion of diapausing larvae (95·2 per cent.) developed from eggs laid 16–20 days after emergence; the unfertilised female laid viable eggs for 24 days, and all those laid 11–15 and 21–24 days after emergence, and 15 of the 16 laid 16–20 days after it, gave rise to larvae that entered diapause.

NIXON (G. E. J.). **Euphorine Parasites of Capsid and Lygaeid Bugs in Uganda.**—*Bull. ent. Res.* **37** pt. 1 pp. 113–129, 46 figs., 4 refs. London, 1946.

Descriptions are given of the adults of two of the four hitherto known African species of *Euphorus* and of ten new species of this genus and one of *Euphoriella*. Eight of the new species were reared by T. H. C. Taylor in the course of work

on Capsid pests of cotton in Uganda [*cf. R.A.E.*, A **34** 13] and comprise *Euphoriella marica* from nymphs of *Sthenarus* sp. on cotton and *Albizzia* and a nymph of *Deraeocoris* sp. taken on cotton in 1930, *Euphorus praetor* from *Lygus simonyi*, Reut. (*vosseleri*, Popp.) on cotton, this and five other species of *Euphorus* from Capsids on other plants, and a sixth from a Lygaeid. The remaining species of *Euphorus* described are *E. nigricarpus*, Szép., which was also reared from Capsids in Uganda, including *L. simonyi*, *Corizidolon* sp. and *Deraeocoris* sp. on cotton, two new species without host records from South Africa, and *Euphorus sahlbergellae*, Wlkn. [*cf.* **32** 288; **33** 195, 196] from *Sahlbergella singularis*, Hagl., and *E. anates*, sp. n., from *Helopeltis* sp., both on cacao in the Gold Coast. *E. sahlbergellae* was also reared from *Boxia khayae*, China [**32** 79] on *Khaya grandifoliola* in the Gold Coast and from *S. singularis* in Nigeria, and *E. anates* is recorded from Nigeria, where its host was not ascertained.

Keys distinguishing the genera *Euphorus* and *Euphoriella* and the 12 species of *Euphorus* are included.

RAHMAN (K. A.) & GURCHARN SINGH SOHI. **Mercury as a Preventive against Stored Grain Pests.**—*Bull. ent. Res.* **37** pt. 1 pp. 131–141, 3 figs., 13 refs. London, 1946.

An account is given of experiments in the Punjab to test the value of free mercury and of tin amalgam prepared according to the method of Dutt & Puri [*R.A.E.*, A **18** 30] for the control of insects in small lots of wheat stored in mud bins, gunny bags, etc. The preliminary tests were made in the laboratory with wheat in small earthen vessels or kerosene tins artificially infested with larvae of *Trogoderma granarium*, Everts; mercury in small cloth bags was placed below the surface and at the bottom and amalgam beaten into thin disks and wrapped in filter paper immediately below the surface of the grain. Free mercury was used at a rate equivalent to about 1 oz. per 100 lb. wheat and amalgam at about 1½ oz., and the containers were sealed with mud plaster. On examination 13 months later, it was found that the free mercury had almost prevented reproduction, whereas the amalgam had had little effect. The latter was no more effective when the rate was tripled. Experiments on a larger scale were then made at four centres with uninfested wheat stored in mud bins capable of holding 780–2,050 lb. to which wheat infested by *T. granarium*, *Calandra oryzae*, L., and *Tribolium castaneum*, Hbst., was added. Mercury in cloth bags at rates of about 1–1¾ oz. per 100 lb. was distributed throughout the wheat so that nearly half of it was within a foot of the surface, where *Trogoderma granarium* is most abundant, and the rest at various depths 8–12 ins. apart; in one bin, the mercury was placed only at the bottom and within a foot of the surface. Tin amalgam was distributed in the same way at rates varying from about 1½ to 4 oz. per 100 lb. When the wheat was examined 9–13 months later, there were few or no living insects in bins in which the mercury was distributed throughout the grain, and very few in the one in which it was placed at the top and bottom only; the insects had bred freely in the presence of tin amalgam and in the controls. The percentage attack throughout the wheat in individual bins was estimated to be 2·1–6·9 for mercury distributed throughout the grain, 8·3 for mercury at the top and bottom only, 7·4–41·9 for amalgam, and 8·1–36·9 in the controls. The loss in weight of infested wheat was negligible in bins treated with free mercury and equal to or greater than that of untreated wheat in those treated with amalgam. Equally satisfactory results were obtained when mercury was added to wheat in bamboo bins infested by *C. oryzae*, *Rhizopertha dominica*, F., *Tribolium castaneum*, *Oryzaephilus* (*Silvanus*) *surinamensis*, L., *Sitotroga cerealella*, Ol., and cadelle beetle [*Tenebroides mauritanicus*, L.] and to metal bins infested by *Trogoderma granarium* and *R. dominica*. In a discussion of

the cost of treatment, it is pointed out that the loss of mercury was negligible, that it can be used year after year if carefully handled and stored, and that wheat treated with it realised a higher price.

Subsidiary laboratory experiments showed that exposure to the vapours of mercury kills the freshly deposited eggs of *T. granarium* and *Bruchus* sp., but has no effect on older eggs [*cf.* **33** 164, 362; **34** 45], retards the growth of the larvae but does not kill them, has no effect on the pupae and slightly reduces the egg-laying capacity of the adults. It had no deleterious effect on the germination or quality of the wheat.

LAL (K. B.). **Recent Advances in the Control of Cane Pests in India.**—*Indian Sug.* Feb. 1944 repr. 6 pp. 1944.

The author gives a list of the more destructive of the insects that attack sugar-cane in India and reviews methods that have been developed there and elsewhere for controlling sugar-cane pests by means of insecticides, mechanical and cultural practices, the development of resistant varieties and the introduction of natural enemies. He also points out the desirability of controlling Aphids that are not in themselves injurious, but transmit mosaic disease of sugar-cane [*Marmor sacchari* of Holmes].

RAHMAN (K. A.). **The Indian Honey-bee (*Apis indica* F.) (Hymenoptera) at Lyallpur.**—*Proc. R. ent. Soc. Lond.* (A) **20** pt. 4–6 pp. 33–42. London, 1945.

This paper, which deals with investigations in an apiary at Lyallpur on the acclimatisation of *Apis indica*, F., in the plains of the Punjab, contains a short section on its natural enemies there. They are the wax moth (*Galleria mellonella*, L.), an undescribed Sphegid of the genus *Palarus*, ants (*Camponotus* sp.) and the bird, *Merops orientalis*. The life-cycle of *G. mellonella* is short at Lyallpur and it is active throughout most of the year. Regular cleaning of the hives and occasional fumigation of surplus combs with sulphur, carbon bisulphide or paradichlorbenzene afford satisfactory control. The species of *Palarus* lives gregariously in the ground and is active during May and June, when it destroys many bees. It was not present in the apiary on cloudy days and during rain, and attack was considerably reduced by shading the entrance to the hive to a distance of about 8–10 ft. in front, or by protecting the entrance by means of low-growing or creeping plants. *Camponotus* sp. is active mostly during the summer and monsoon seasons and sometimes drives the bees out of the hive. It was controlled by pouring a solution of 1 oz. potassium cyanide in 4 gals. water into the nests within 100 ft. of the apiary, and the hives were protected by standing the legs in cups filled with water.

EWER (R. F.). **The Effect of Grain Size on the Oviposition of *Calandra granaria* Linn. (Coleoptera, Curculionidae).**—*Proc. R. ent. Soc. Lond.* (A) **20** pt. 4–6 pp. 57–63, 1 fig., 2 refs. London, 1945.

The experiments described were carried out at 25°C. [77°F.] and a relative humidity of 70 per cent. on wheat in equilibrium with this humidity. When ovipositing females of *Calandra granaria*, L., were confined singly in tubes each containing one large and one small wheat grain, 66·6 per cent. of the eggs were deposited in the large grains, and when the large and small grains were presented alternately for two-day periods, the percentage deposited in the large ones was 56·4. Similar results were obtained when large and small grains were presented alternately for periods of one day, so that the preference was not due to a loss of attractiveness in grains containing relatively many eggs. The preference for large grains was still apparent in tests in which the

females were enclosed with samples of 12 gm. wheat consisting of large and small but no medium-sized grains; in one such test, the total surface area exposed by the large and small grains was the same, so that the higher proportion of eggs in large grains does not appear to be due to larger available surface area. When the weevils were enclosed with a greater amount of grains of all sizes, the preference for large grains was shown by small weevils as well as by large ones, so that it would seem to be due to physico-chemical differences in the grains rather than to size. No differences were found in the equilibrium water content of large and small grains from the same sample. When females were placed on wheat comprising large and small grains so arranged that the small grains were on one side of the container and the large on the other, rather more eggs were laid in the larger grains in three tests out of four, but the size of the grains apparently had little influence on the distribution of the weevils throughout the sample.

CHIARELLI DE GAHAN (A.). **Larva de microlepidóptero que ataca al lino *Eulia loxonephes*, Meyr. (Tortricidae).** [A Microlepidopterous Larva attacking Flax, *E. loxonephes*.]—[*Publ.*] *Inst. Sanid. veg.* (A) **1** no. 2, 11 pp., 9 figs., 3 refs. Buenos Aires, 1945.

The Tortricid, *Eulia loxonephes*, Meyr., which was originally described from *Dahlia* in La Pampa in 1937, was injurious to flax in a district to the north-west of Buenos Aires in 1941. The larvae spun the leaves of the terminal shoots together and fed on the edges of the leaves and on the peduncles. Only one larva occurred per shoot. When confined with males in the laboratory, the females oviposited 11 days after emergence and laid up to 170 eggs, singly or in groups, on the leaves and twigs and also on the walls of the glass tubes and on gauze. The eggs hatched in 14 days at 20°C. [68°F.], the larvae pupated about a month later, and the pupal stage lasted a week, at 20–22°C. [71·6°]. All stages are described.

VERGANI (A. R.). **Transmisión y naturaleza de la "lepra explosiva" del naranjo.** [Transmission and Nature of Lepra Explosiva of Orange.]—[*Publ.*] *Inst. Sanid. veg.* (A) **1** no. 3, 11 pp., 4 figs., 4 refs. Buenos Aires, 1945.

An account is given of experiments begun in 1939 on the cause of the affection of oranges known as lepra explosiva that is common in the Province of Corrientes, Argentina [*cf. R.A.E.*, A **26** 581; **32** 340]. Typical symptoms appeared after periods that ranged from 55 days to 18 months when batches of 60–100 examples of *Tenuipalpus pseudocuneatus*, Blanch., taken in 1939 from affected twigs and fallen fruits of sweet orange, were transferred to healthy orange plants that had previously been disinfected with alcohol, so that there is probably considerable variation in the individual resistance of plants; those exposed to the direct rays of the sun were the first to show symptoms. In 1940, plants infested during January with batches of 50 mites showed symptoms during April or early May, and they also appeared after similar intervals on fruits on grafts when batches of 50 mites were placed on the rind; in one such case, they appeared after six months on the twigs of the experimental plants, to which the mites had presumably migrated. No symptoms were induced by grafting or by the inoculation of crushed mites or of sap from fresh lesions, and the condition is not transmitted through the seed. It is concluded therefore that it is due to a toxin injected by the mites in the process of feeding and not to a virus [*cf. loc. cit.*].

LOPEZ MANSILLA (E. E.). **Biología de la filóxera de la vid (*Viteus vitifoliae* Fitch) en la Provincia de San Juan.** [The Biology of the Vine Phylloxera, *Phylloxera vitifoliae*, in the Province of San Juan.]—[*Publ.*] *Inst. Sanid. veg.* (A) **1** no. 5, 35 pp., 21 figs., 40 refs. Buenos Aires, 1945. (With a Summary in English.)

Phylloxera (*Viteus*) *vitifoliae*, Fitch, occurs on the roots of European grape vines over a considerable area in the Province of San Juan, Argentina, and investigations on its bionomics, some of which have already been noticed [*R.A.E.*, A **31** 428], were carried out, by a technique that is described, in the laboratory and in the open in the four years 1940–43. The various forms observed (nymphs, apterous and alate parthenogeniae, and their eggs) are described. There were seven overlapping generations in the year, and the durations of the various stages in each of them are shown. Apterae laid an average of 81 eggs in 18 days at 22°C. [71·6°F.], and alatae, which appeared in the laboratory under conditions of crowding in December and January and were also taken in the field, laid 6–8 eggs, generally at one time. Third-instar nymphs died with the onset of cold weather, and the overwintering population consisted of nymphs of the seventh generation that hatched in March or April, together with those of the preceding two generations that had not reached the third instar. They overwintered on any part of the roots, but generally in cracks or folds of the bark.

The spread of infestation is gradual in the field, and laboratory experiments showed that it is due both to winged adults and to nymphs moving through or over the soil. Flooding the roots gave complete control in experiments, but it is feared that the snow water that is used for irrigation in the most seriously affected area would prove harmful to the vines.

Various attempts were made to colonise the Aphid on the roots of American vines, but all failed. The relations between temperature and the duration of development of the various stages and between length of the oviposition period and the number of eggs laid are analysed statistically in a final section.

BLANCHARD (E. E.) & others. **Insectos y Nemátodos relacionados con el cultivo del tabaco.** [Insects and Nematodes related to the Cultivation of Tobacco.]—[*Publ.*] *Inst. Sanid. veg.* (A) **1** no. 6, 23 pp., 6 refs. Buenos Aires, 1945.

This is a systematic list of 91 insects and 4 Nematodes that are associated with tobacco in the field in Argentina. The insects comprise those that are injurious and those that are parasitic or predacious on injurious species, and notes are given on their local distribution and frequency, the economic importance and in some cases the appearance and control of those that are pests, and the species attacked by the parasites and predators.

MARCHIONATTO (J. B.). **Nota sobre algunos hongos entomógenos.** [A Note on certain Entomogenous Fungi.]—[*Publ.*] *Inst. Sanid. veg.* (A) **1** no. 8, 11 pp., 1 col. pl., 3 figs., 21 refs. Buenos Aires, 1945.

Recent records are given of the ocurrence of entomogenous fungi, mainly in Argentina. *Acrostalagmus aphidum*, which had been recorded from the green peach Aphid [*Myzus persicae*, Sulz.] in Argentina in 1939, was subsequently observed there on *Toxoptera graminum*, Rond. [*R.A.E.*, A **30** 277] and *T. aurantii*, Boy. *Beauveria globulifera* [*cf.* **23** 12] was found on *Bombyx mori*, L., from Viçosa, Brazil, *Cydia* (*Laspeyresia*) *molesta*, Busck, from La Plata, Argentina, and *Listroderes* sp. from Montevideo, Uruguay; *Cephalosporium lecanii* [*cf.* **23** 12] on *Icerya purchasi*, Mask., and *Pulvinaria flavescens*, Brèth., from La Plata; *Cladosporium aphidis*, which is possibly only saprophytic, on

various Aphids also infested by *Empusa* spp. from Buenos Aires and Montevideo ;. *Empusa americana* on the Tachinid, *Parexorista caridei*, Brèth., from La Pampa, Argentina ; *Entomophthora* (*Empusa*) *aphidis* on various Aphids, including *Brevicoryne brassicae*, L., from La Plata and *T. graminum* from Uruguay ; and *Spicaria prasina* on larvae of *Alabama argillacea*, Hb., from cotton in Tucuman, Argentina.

FREIBERG (M. A.). **Contribución al conocimiento de la biología de *Alabama argillacea* (Hübner) oruga de la hoja—plaga del algodonero.** [A Contribution to Knowledge of the Bionomics of the Leaf Worm, *A. argillacea*, a Pest of Cotton.]—[*Publ.*] *Inst. Sanid. veg.* (A) **1** no. 9, 16 pp., 9 figs., 25 refs. Buenos Aires, 1945.

Alabama argillacea, Hb., all stages of which are described, is one of the most important pests of cotton in Argentina and causes great injury when it appears in numbers. The larvae are present from January onwards, and reproduction continues until April or sometimes early May if conditions are favourable. Laboratory observations in the Chaco showed that the egg stage lasts 3–4 days and the larval and pupal stages together about 3 weeks, though the latter vary with temperature and lasted about 3 and 2–4 weeks, respectively, in May–July [*cf. R.A.E.*, A **32** 13]. The adults survived for about 35 days, with a maximum of 54, and the females oviposited 8–14 days after emergence. Two that emerged in the first half of May laid 493 and 405 eggs in two and three batches at intervals of 2 and 2–3 days, respectively. All stages are susceptible to cold, and it is thought unlikely that any of them overwinter in Argentina. The moths fly long distances, and flights have been observed in Brazil to be connected with rain [*cf.* **29** 404]. Infestation in Argentina is slight in dry years and probably originates in each season from moths that have migrated from southern Brazil.

GRIOT (M.), GAHAN (H.), SILBERMAN (R.) & ICART (A.). **Observaciones sobre un parásito secundario del "bicho de cesto."** [Observations on a secondary Parasite of the Bagworm.]—[*Publ.*] *Inst. Sanid. veg.* (A) **2** no. 10, 7 pp., 4 figs., 6 refs. Buenos Aires, 1946.

Four species of *Tetrastichus*, *T. platensis*, Brèth. [*R.A.E.*, A **15** 408], *T. isis*, Brèth. [**7** 125], *T. oeceticola*, Brèth. [**8** 298, 299] and *T. pseudoeceticola*, Blanch. [**25** 788], have been recorded as parasitic on larvae of *Oeketicus* (*Oeceticus*) *kirbyi*, Guild., and *T. pseudoeceticola*, the egg and larva of which are described, was reared on several occasions from bags of this Psychid collected in Argentina in July–September 1944. When the contents of some of the bags were examined, however, larvae of *T. pseudoeceticola* were found feeding externally on larvae of *Spilochalcis bergi*, Kby., an endoparasite of the bagworm. It is not known how this hyperparasitism takes place or how the hyperparasite survives during spring and summer, when larvae of its host are not available. Larvae of *S. bergi* become full-fed when the bagworms reach the pupal stage, and up to nine have been observed in a single host. The adults emerge in March–April, but full-fed larvae have been observed in June–July. In experiments, females of *T. pseudoeceticola* deposited eggs on normal, well developed larvae of *S. bergi* taken from the bags of *O. kirbyi* ; many larvae developed on each, and adults emerged after 25 days at 25°C. [77°F.].

The Potato Tuber-moth and its Enemies.—*Agric. Bull. Bermuda* **24** no. 5 pp. 29–31. [Hamilton] 1945.

Gnorimoschema (*Phthorimaea*) *operculella*, Zell., was first recorded in Bermuda in 1931 [*cf. R.A.E.*, A **22** 306] and has since caused much damage there. It is

found in potato fields from late March until the crop is dug and in stored potatoes from April until August; it has not been observed between September and late March, and the winter crop of potatoes is not attacked. Injury to the foliage is unimportant, but damage to tubers may cause heavy losses. Tubers are attacked if they are not well covered with earth during the growing season and at the time of digging, and infestation may increase rapidly in storage [*cf.* **29** 138]. The leaves of tobacco and the leaves and fruit of tomato are also infested. Two parasites, *Chelonus phthorimaeae*, Gah., which oviposits in the eggs of the host and develops in the larvae, and *Bracon* (*Microbracon*) *gelechiae*, Ashm., which oviposits in larvae that are almost ready to pupate, have recently been introduced from California, and 130,000 examples have been liberated.

ALLEN (T. C.) & BRUNN (L. K.). **Increased Toxicity of Lime-treated Sabadilla Seed in Dust Suspensions.**—*J. econ. Ent.* **38** no. 3 pp. 291–293, 4 refs. Menasha, Wis., 1945.

As treatment of the powdered seed of sabadilla [*Schoenocaulon*] with heat, alkali or both before extraction with kerosene increased the toxicity of the extract to *Musca domestica*, L. [*R.A.E.*, B **33** 66], further tests were carried out in Wisconsin to determine whether similar treatment would be advantageous in the preparation of dusts for controlling other insects. Coarsely ground seed (30 mesh) was milled with lime containing a high proportion of calcium, or heated for four hours at 75–80° C. [167–176° F.], cooled and finely ground with pyrophyllite (Pyrax ABB), or moistened with a 10 per cent. solution of sodium carbonate at the rate of 20 cc. per 100 gm. seed, dried and milled with pyrophyllite. The dusts were diluted with pyrophyllite or lime, neither of which showed appreciable toxicity, and applied to reared adults of *Oncopeltus fasciatus*, Dall., under bell-jars. After treatment, the insects were removed to clean cages and provided with food and water. At a concentration of 1 per cent. sabadilla, all treated and untreated samples were highly toxic; while at 0·75 per cent., toxicity was less and there were greater differences between treatments. In a series of comparative tests, the percentage mortalities after 72 hours averaged 76 for sabadilla ground with lime, 41 for treatment with sodium carbonate and 9 for the heat treatment, as compared with 25 for untreated sabadilla, and lime was a more effective diluent than pyrophyllite. In further tests, a dust containing 1 per cent. sabadilla activated with lime gave an average percentage mortality of 92 after 72 hours, as compared with 73 and 52 for dusts containing 0·1 per cent. pyrethrins and 2 per cent. DDT, respectively.

When field-collected examples of *Melanoplus femur-rubrum*, Deg., were dusted by the same technique, the percentage mortalities after 48 hours were 92·5, 75 and 40 for lime-treated dusts containing 20, 10 and 5 per cent. sabadilla applied to the adults, as compared with 82·5, 30 and 10 for similar untreated dusts, and 90 for a lime-treated dust containing 20 per cent. sabadilla applied to nymphs, as compared with 37·6.

Treatment or dilution with lime is therefore considered the most effective method of activating dusts of sabadilla.

ALLEN (T. C.), LINK (K. P.), IKAWA (M.) & BRUNN (L. K.). **The relative Effectiveness of the principal Alkaloids of Sabadilla Seed.**—*J. econ. Ent.* **38** no. 3 pp. 293–296, 2 figs., 5 refs. Menasha, Wis., 1945.

As the total alkaloids (veratrine) of sabadilla [*Schoenocaulon*] are only slightly soluble in kerosene and the toxicity of the constituents to house-flies [*Musca domestica*, L.] has been measured only in kerosene solutions [*cf. R.A.E.*, B **34** 163], investigations were carried out to determine their relative toxicities in dust suspensions to adults of *Oncopeltus fasciatus*, Dall., and adults and

nymphs of *Melanoplus femur-rubrum*, Deg.; the toxicity of kerosene solutions of the alkaloids to *Oncopeltus* was also tested. Veratrine, veratridine, cevadine, cevine, hydrochlorides of veratrine and the oil obtained by petroleum ether extraction of the seed were mixed in various proportions with pyrophyllite (Pyrax ABB), and 500 mg. dust mixture was injected into a bell jar of 1·25 cu. ft. capacity containing the caged insects. These were exposed to the dust suspension for three minutes and then transferred to clean cases and supplied with food and water. The kerosene solutions were tested as a settling mist by atomising 3 cc. into the upper end of the bell jar, and the period of exposure was two minutes [*cf.* B **31** 210], after which the insects were transferred to clean cages and provided with food and water. Observations on mortality were made for a period of 72 hours.

The following is based on the authors' conclusions. In the dusts, cevadine was the most toxic constituent to *O. fasciatus* and *M. femur-rubrum*. Veratrine, veratridine and the hydrochlorides of veratrine were considerably less effective, and cevine and the oil obtained from petroleum ether extraction were not toxic even at concentrations of 1 : 100. The median lethal concentration of cevadine was 1 : 8,000 for *O. fasciatus* and 1 : 2,000–3,000 for *M. femur-rubrum*. In a kerosene solution, cevadine was more toxic than veratridine to *O. fasciatus*, the respective median lethal concentrations being 1 : 2,000 and 1 : 500. When DDT was tested against *O. fasciatus* under the same conditions, its median lethal concentration in kerosene was 1 : 10.

LINDGREN (D. L.) & DICKSON (R. C.). **Repeated Fumigation with HCN and the Development of Resistance in the California Red Scale.**—*J. econ. Ent.* **38** no. 3 pp. 296–299, 4 refs. Menasha, Wis., 1945.

The following is based on the authors' discussion. The two populations of *Aonidiella aurantii*, Mask., one resistant and the other non-resistant to fumigation with hydrocyanic acid gas, that have been reared continuously in the laboratory in California since 1936 [*cf.* *R.A.E.*, A **27** 343] had passed through some 70 generations by 1944, and in order to discover whether any changes in resistance were taking place, samples of both were fumigated at intervals of two years. The results showed that the difference was maintained throughout the period, even though the stock cultures had received no fumigations and the resistant scales were not a pure resistant race. In 1939–40, nine cultures of originally resistant, semi-resistant and non-resistant scales were set up in the laboratory and fumigated up to 18 times at various concentrations. Evidence of an increase in resistance was obtained in all categories [*cf.* **32** 271], but the increase was not maintained beyond a certain maximum. Resistance in any scale-infested grove has probably been brought about by selection of the resistant forms by fumigation, but it is evident that even populations that have a record of being very resistant may become still more so. It is difficult to attribute increased resistance entirely to the elimination of non-resistant individuals in the original stocks, since in the repeated fumigations of the resistant cultures, the concentration of HCN was approximately 2–4 times as great as that used for the non-resistant ones (0·36 and 0·7 mg. per litre as compared with 0·19 mg. per litre).

A partial explanation of the slowness in the practical elimination of genes for non-resistance may be found in the mechanism of inheritance. While the males are either entirely resistant or entirely non-resistant, it seems unlikely that many of them survived. The females, on the other hand, may be resistant, non-resistant or semi-resistant. The semi-resistant females are heterozygous, carrying genes for resistance and non-resistance, and are midway between the two races in their ability to survive fumigation with HCN. In a scale population predominantly resistant, very few females homozygous for non-resistance will be found, nearly all the genes for non-resistance being carried by individuals

that also carry genes for resistance. Therefore, in the development of a purely resistant race, it is not the non-resistant individuals that must be eliminated so much as the semi-resistant ones, which are relatively hard to kill. The more nearly the population becomes purely resistant, the greater is the likelihood that the genes for non-resistance present will be contained in semi-resistant females, and hence the slower the population change.

GAINES (R. C.). **Effect of reduced Amounts of Calcium Arsenate on Boll Weevil Control and Cotton Yield.**—*J. econ. Ent.* **38** no. 3 pp. 300–304, 2 graphs, 1 ref. Menasha, Wis., 1945.

The results of field-plot experiments on the control of the boll weevil [*Anthonomus grandis*, Boh.] on cotton, carried out at Tallulah, Louisiana, in 1933–43, in which the rate of application of calcium arsenate per acre was reduced by mixing it with such carriers as lime, sulphur or clay, none of which has any great effect on the weevil, are given in a table and analysed by the method of least squares. Applications of 8, 7, 6, 5, 4, 3 and 2 lb. calcium arsenate per acre are estimated to give 65, 61, 56, 50, 43, 34 and 23 per cent. control, respectively, and the corresponding yields of seed cotton are 2,129, 2,098, 2,067, 2,036, 2,005, 1,974 and 1,943 lb. per acre, as compared with 1,815 lb. for no treatment. The effect of dosage on percentage control was significant, but that on yield was not. The results are also given of cage tests with similar mixtures. No records were made of dosage, but an attempt was made to apply equal amounts of calcium arsenate alone and of mixtures of calcium arsenate and some diluents, thereby reducing the dosage of calcium arsenate, and the relation between the amount of calcium arsenate applied and mortality of the weevils was evident.

HANSBERRY (R.) & CLAUSEN (R. T.). **Insecticidal Properties of miscellaneous Plants.**—*J. econ. Ent.* **38** no. 3 pp. 305–307, 3 refs. Menasha, Wis., 1945.

The results are given of investigations on a large number of plants of the western hemisphere carried out in New York to ascertain their possible value as insecticides. The plant tissue was dried and ground, and the dust obtained was blown up into a dusting tower and allowed to settle on leaves and test insects in a heavy layer; larvae of the bean beetle [*Epilachna varivestis*, Muls.] were used for the initial tests and mortality counts were made daily for four days, unless the foliage had been completely consumed and less than 10 per cent. mortality had occurred after two days.

Five species of fish-poison plants from Brazil showed no toxicity to larvae of *Epilachna*, but seeds of red- and black-seeded varieties of *Pachyrhizus tuberosus* were about as toxic as typical *P. erosus* from Mexico [*cf. R.A.E.*, A **32** 277]. Ground roots of *Lonchocarpus utilis* and *L. urucu*, which comprise most of the cubé and timbo of commerce, from Brazil were found to contain 5·6 and 4·9 per cent. rotenone and 16·7 and 13·9 per cent. ether extract, respectively, and tests against larvae of *Epilachna* showed a higher toxicity per unit of rotenone for *L. utilis*. As *L. urucu* gives a higher yield of root, however, it is the preferred species for cultivation.

Tests of most of the leguminous plants of New York, with a few introduced species and a few from other States, and of a number of non-leguminous plants of New York, showed that with the exception of *Amorpha fruticosa* (seeds) and *Tephrosia virginiana* (roots), which showed moderate toxicity, none was toxic. Of 21 species of plants from Mexico and Central America, only the roots of *Tephrosia* spp. were toxic, and even *T. toxicaria*, which is reputed to be highly poisonous [*cf.* **26** 29], killed less than half the *Epilachna* larvae in four days.

Miscellaneous plants tested included *Clibadium surinamense* and *Pithecellobium trapezifolium* from Dominica, of which the aerial parts and the leaves, respectively, were highly toxic to silkworms [*Bombyx mori*, L.], though neither was effective against *Epilachna* or Aphids; and *Tephrosia vogeli* from French Guiana, of which the leaves contained 1 per cent. rotenone and 7·6 per cent. total ether extractives and were as toxic to larvae of *Epilachna* when ground and mixed with equal quantities of talc as a 0·5 per cent. rotenone dust prepared from cubé root. Seedlings of this plant grew to a height of 6 ft. in one year in the greenhouse, so that its potential yield of rotenone-bearing tissue may be fairly high. Sap from *Hyra polyandra* from Mexico, which had fermented, gave moderate kills of Aphids when used as a contact spray at a concentration of 1 : 10, and *Maurandia antirrhiniflora* from Mexico killed 86 per cent. of silkworms in four days, though it was ineffective against larvae of *Epilachna* and of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say]. The other plants tested showed no toxicity.

FLEMING (W. E.). **Evaluating the Effectiveness of Sprays against the Japanese Beetle: a Laboratory Method.**—*J. econ. Ent.* **38** no. 3 pp. 308–312, 2 refs. Menasha, Wis., 1945.

The following is based on the author's summary and conclusions. A method requiring a relatively small amount of test material was developed in 1943 for the preliminary evaluation of the repellency of sprays to adults of *Popillia japonica*, Newm., under controlled conditions of temperature, relative humidity and light. Uniform potted plants of *Polygonum pennsylvanicum* were arranged in a latin square 7 by 7 in a large chamber, the floor of which was covered with moist sand. Each series included unsprayed plants and plants treated with a spray of 6 lb. lead arsenate and 1½ U.S. pints fish oil per 100 U.S. gals. and five test sprays. A total of 3,000 beetles was liberated in the chamber, and records were made at intervals of the number of beetles per plant and the extent of feeding for each treatment. The effectiveness of each test spray was compared with that of lead arsenate and was evaluated according to the relative reduction in the number of beetles on the plants and the relative protection that was afforded to the foliage. It was found possible to complete an evaluation of a test spray in 48 hours.

POOS (F. W.) & HETRICK (L. A.). ***Tetralopha scortealis* (Led.) a new Insect Pest of *Lespedeza*.**—*J. econ. Ent.* **38** no. 3 pp. 312–315, 2 figs. Menasha, Wis., 1945.

In recent seasons, outbreaks of *Tetralopha scortealis*, Led., on *Lespedeza* have caused concern in Virginia, and this Pyralid, which occurs from Maryland to Florida, has also been found on *Lespedeza* in Maryland, South Carolina and Georgia. The larvae form webs similar to those produced by young larvae of *Tortrix* (*Archips*) *obsoletana*, Wlk., and feed on the leaves. *L. cuneata* (*sericea*) appears to be the preferred food-plant, but *L. stipulacea* and *L. striata* have been severely infested; *L. cyrtobotrya*, *L. hedysarioides* and *L. bicolor* are also attacked, though only a few webs have been found on the last two. The larvae have been observed on wild and native species of *Lespedeza* and *Desmodium*, but not on lucerne, though they accepted this under cage conditions. The presence of webs hinders the proper curing of *Lespedeza* hay, but the greatest damage is due to the consumption of the leaves, and this also reduces seed production. The larvae apparently feed chiefly at night, concealing themselves within their webs during the day, and most webs contained 3–7 larvae. There were two generations in the year in Virginia, with some indication of a partial third. Larvae of the first were present in late June and early July; they dropped to the surface of the soil when fully fed and

formed cocoons in which to pupate. Adults emerged during late July and early August. Eggs were abundant on *L. cuneata* on 8th August, and webs of the second-generation larvae were numerous during late August and most of September. The winter is presumably passed in the prepupal stage within the cocoon ; only one individual has overwintered successfully under laboratory conditions, the adult emerging on 24th May. The eggs were occasionally deposited singly, but usually in groups of 3–11, on the midrib of the upper surface of the leaf, and hatched in a few days.

Most of the larvae were killed by a disease in September, and this may have prevented the development of another generation. Parasites do not seem to be important, but *Perilampus fulvicornis*, Ashm., and an undescribed species of *Haltichella*, which were possibly hyperparasitic, were reared from the pupae, and adults of *Frontiniella parancilla*, Tns., *Macrocentrus delicatus*, Cress., and *Triclistus fulvipes*, Cress., were recovered from cages containing larvae of *Tetralopha*. In preliminary tests, a dust of undiluted cryolite (not less than 83 per cent. sodium fluoaluminate and 45 per cent. fluorine) and another containing 2 per cent. DDT killed the larvae, and two applications to the plants, on 8th and 19th August, gave excellent protection. A dust containing 0·5 per cent. rotenone, applied on the same dates, did not give satisfactory control. Production of seed was greater on plants treated with cryolite or DDT than on heavily infested untreated plants. A single application of either of these materials to badly webbed *Lespedeza* as late as 1st September gave good control and hastened recovery of the plants, although it was too late for the production of a normal crop of seed. Further experiments are required before either of these materials can be recommended for use on hay crops.

SMITH (H. S.). **Cost of producing *Macrocentrus* by the Potato-tuber-worm Method.**—*J. econ. Ent.* **38** no. 3 pp. 316–319, 2 figs., 3 refs. Menasha, Wis., 1945.

The author gives figures showing the numbers of examples of *Macrocentrus ancylivorus*, Rohw., liberated in different counties of California in 1944 against the oriental fruit moth [*Cydia molesta*, Busck]. The 19 million parasites released were reared on larvae of *Gnorimoschema operculella*, Zell., on potato tubers [*cf. R.A.E.*, A **32** 367], and he estimates that the principal current expenses in their production amounted to $15,170. Labour costs, which represent nearly half of this figure, are, however, being reduced rapidly by improvements in the rearing technique.

FINNEY (G. L.), MARTIN (C. H.) & FLANDERS (S. E.). **Influence of Moisture on the Mass Propagation of *Macrocentrus ancylivorus*.**—*J. econ. Ent.* **38** no. 3 pp. 319–323, 6 refs. Menasha, Wis., 1945.

The following is substantially the authors' summary. In the course of mass propagation of *Macrocentrus ancylivorus*, Rohw., in California in 1944 [*cf. R.A.E.*, A **32** 367] it was found that the efficiency of the process depended on the regulation of the evaporation of moisture from the potato tubers on which the larvae of *Gnorimoschema operculella*, Zell., fed. The rate of moisture loss was determined by the variety of potato (being lower in Russet than in White Rose), the degree of infestation and the amount of aeration. Under conditions optimum for efficient propagation of *M. ancylivorus*, the potato tuber lost 75 per cent. of its weight in 20 days through evaporation. A " dry " potato such as Russet can be used efficiently when the evaporation power of the air is relatively low, whereas a " moist " one such as White Rose can be used efficiently only when it is relatively high. The difference in time of emergence of host and parasite populations varies with the density of the host

infestation, the percentage parasitism and the degree of uniformity in development of both the host and its parasite.

Low humidities, directly or indirectly, tend to inhibit oviposition by *Macrocentrus*.

FLANDERS (S. E.). **The Role of the Spermatophore in the Mass Propagation of** *Macrocentrus ancylivorus*.—*J. econ. Ent.* **38** no. 3 pp. 323–327, 1 fig., 5 refs. Menasha, Wis., 1945.

The following is based on the author's summary. Studies on *Macrocentrus ancylivorus*, Rohw., and the application of the information obtained to the mass production of the parasite on larvae of *Gnorimoschema operculella*, Zell., in the laboratory [*cf. R.A.E.*, A **32** 367] show that the maximum amount of parasitism and the maximum percentage of female offspring can be obtained under mass-production conditions by eliminating the factors that prevent impregnation of the female parasites. These factors, which include excessive heat, light and parasite density during mating and for a short period afterwards, apparently prevent the proper placement of the spermatophore, or cause its premature dislodgment, and prolong the pre-oviposition period. The impregnation of the female appears to be dependent on the position of the spermatophore in relation to the sperm duct. The spermatophore is cast out of the body before oviposition occurs. When superparasitism occurs, the exclusively male progeny of unmated females may predominate over the progeny from eggs deposited later by impregnated females in competition for the host.

LATHROP (F. H.) & DIRKS (C. O.). **Timing the seasonal Cycles of Insects : the Emergence of** *Rhagoletis pomonella*.—*J. econ. Ent.* **38** no. 3 pp. 330–334, 3 figs., 7 refs. Menasha, Wis., 1945.

Sprays for the control of *Rhagoletis pomonella*, Walsh, on apple, in Maine should generally be applied when 0·1 and 50 per cent. of the adults have emerged from the soil. Accurate timing of emergence is of importance, and since the authors had already shown that a phenological scale was more accurate for such a purpose than one based on calendar dates [*R.A.E.*, A **33** 42], the emergence of adults of *R. pomonella* was studied in relation to temperature, rainfall and date of petal-fall of apple.

Field-cage tests carried out in 1933–43 showed that emergence followed a characteristic seasonal pattern that varied only to the extent of approximately nine days from the mean at the 50 per cent. level. When plotted, the cumulative emergence of adults takes the form of a sigmoid curve, the variance in emergence probably resulting partly from differences in environment and partly from differences in the physiological response of individual flies. Attempts were made to follow the emergence of the flies through the season and to estimate the time of emergence of any given percentage of the total. Each level of emergence was considered as a somewhat separate stage in the development of the insect, exhibiting a distinctive reaction to environmental factors, and a more or less independent study was made for each. It was found that 0·1, 50 and 90 per cent. of the adults emerged, on the average, 29·3, 49·2 and 60·2 days after petal-fall and when the sum of daily mean temperatures beginning 30 days before petal-fall totalled 3,524·7, 4,917·2 and 5,682·1°F., and the rainfall, beginning on the same date, totalled 6·02, 7·51 and 9·23 ins., respectively. The correlation between emergence and the sum of daily mean temperatures for the period chosen was high, and higher than for longer or shorter periods. That between emergence and rainfall was statistically less significant ; it was highest early in the season, ceased to be significant at the level of 75 per cent. emergence, and was almost non-existent at 90 per

cent. That between emergence and date of petal-fall was not significant except at the 90 per cent. level. The data appeared to indicate that, on the average, emergence begins at about the same interval after petal-fall, whether this is early or late, but in seasons in which it is early, emergence may be expected to continue over a longer period than when it is late, which suggests that emergence may continue over a somewhat longer period in the south than in the north, though it will begin the same length of time after petal-fall.

Estimates of the time of emergence of the flies were made for the three levels of emergence in each of the 11 years by three methods. The use of the mean calendar dates led to the greatest errors, and though estimates based on the mean number of days after petal-fall were much more accurate, the best results were obtained by taking the mean of estimates based on temperature, rainfall and petal-fall. The estimates for temperature were based on the averages already obtained, those for rainfall were obtained by substituting in the regression formula the total rainfall that occurred in the period from 30 days before petal-fall to the dates estimated from temperature, and those for date of petal-fall by substituting in the regression equation the date on which petal-fall occurred. This method gave reasonably accurate results in each of the 11 years, except for the 0·1 per cent. level in 1938 and the 90 per cent. level in 1942, and it is considered that it will be possible to time the emergence of the flies within satisfactory limits, unless exceptional combinations of climatic factors introduce wide errors. It may ultimately prove possible to use official forecasts for temperature and rainfall several days ahead in predicting the emergence dates.

CARTER (Walter). **The Oral Secretions of the Pineapple Mealybug.**—*J. econ. Ent.* **38** no. 3 pp. 335–338, 3 figs., 9 refs. Menasha, Wis., 1945.

The author describes methods of feeding *Pseudococcus brevipes*, Ckll., in the laboratory on solid agar gels (2–3 per cent. agar), or on nutritive media through agar films, and the results of investigations made in Hawaii by the former method of the nature of the oral secretions of the mealybug. The tubular feeding tracks formed by the droplets of saliva that harden in the agar can be dissected from the block, and their presence indicates the immediate areas fed upon. As, however, the symptoms caused in pineapples by the mealybug [*R.A.E.*, A **21** 64; **33** 345, etc.] involve more than the area fed upon, it is necessary to postulate either a catalysis at the feeding point or an actual diffusion of elements of the secretion beyond it. Experiments with radio-active phosphorus as the tracer element showed that diffusion can occur.

When mealybugs were fed for six days on an agar block containing radio-active sodium phosphate and then removed to a block containing none, the latter was radio-active after two days, and when the edges to which the mealybugs were attached were cut away after ten days, the remainder was radio-active. Nitrogen readings taken from the inner portion of agar blocks on which mealybugs had fed indicated that they utilised the nitrogen in the agar. When mealybugs that had fed on radio-active agar for six days were transferred to the leaves and roots of plants growing in water-vapour culture boxes, both became radio-active and more phosphorus was recovered from the leaves than from the roots, the shortest time before positive results were obtained from the roots being 31 days. Radio-active phosphorus was recovered from the roots in 12 days, however, when it was injected into the plants by means of capillary tubes.

Radio-active phosphorus was demonstrated in the body and the separate organs of mealybugs that had fed on agar containing it.

The deposition of feeding tracks and the diffusion of other elements of secretion beyond them indicated the complexity of the secretion. At least some fractions of it are apparently independent of complete nutrition, since the

feeding track is laid down during successive transfers to plain agar as long as the insect lives, the striping of pineapple leaves [**33** 345] has resulted from the feeding of mealybugs that had previously been maintained on a plain agar gel for 6–7 days, and no change in the capacity of some of the mealybugs to cause green spotting [**21** 64] has been noted as a result of artificial feeding.

MARLOWE (R. H.). **Effect of Foods on Ovarian Development in the Melon Fly.**—*J. econ. Ent.* **38** no. 3 pp. 339–340, 3 refs. Menasha, Wis., 1945.

In the course of rearing large numbers of *Dacus cucurbitae*, Coq., in the laboratory in Hawaii, it was observed that the numbers of eggs laid by individual females varied with the food given and the season of the year, and preliminary studies were therefore made on the effect of food on the development of the ovaries and also on the effect of a small amount of tartar emetic on egg production [*cf. R.A.E.*, A **29** 494]. Newly emerged flies were provided with moist cotton and either fruit juice or sliced fruit changed daily or a solution of sucrose or molasses, changed as often as necessary. The temperature varied from 70 to 75°F. After 30 days, the surviving females were killed and the ovaries of these and of those that had died earlier were examined microscopically. Normal development was found in those fed on fruit juice or sliced fruit, but none in those fed on sucrose or molasses, and the addition of yeast to molasses had no effect. Flies fed on cucumber juice and examined after 27 days had fully developed ovaries containing eggs, but there was no ovarian development in those fed on cucumber juice containing 120 parts tartar emetic per million and all were dead in 27 days. In a further test, females fed on sucrose showed no ovarian development after 90 days.

GARMAN (P.). **Further Studies of Apple Spray Schedule Reduction.**—*J. econ. Ent.* **38** no. 3 pp. 341–343. Menasha, Wis., 1945.

A brief account is given of some of the investigations in which the quantity of lead arsenate commonly used as an insecticide on apple trees in Connecticut was applied in less than the usual number of sprays [*cf. R.A.E.*, A **34** 219–221]. By the use of suitable adhesives and fungicides, satisfactory control of the major pests was obtained, and the most practical basic formula for future experiments is considered to include 6 lb. lead arsenate, 1½ lb. Fermate (ferric dimethyl-dithiocarbamate) and either 3 lb. aluminium gel (aluminium hydroxide or aluminium silicate) or 2½ lb. bentonite and ½ lb. skim milk per 100 U.S. gals.

EYER (J. R.). **Solid Baits for Codling Moth.**—*J. econ. Ent.* **38** no. 3 pp. 344–346, 1 fig., 2 refs. Menasha, Wis., 1945.

The author describes the preparation of solid media containing attractants for the codling moth [*Cydia pomonella*, L.] that are easy to make, harden on exposure to air and did not interact unfavourably with the attractants used. Four parts of a mixture of 250 gm. gum arabic, 250 cc. cane syrup and 500 cc. water, with the addition of about 1 part sawdust, was effective when used with pine-tar oil, safrole, acetic acid and valeric acid in tests in 1944 in orchards in different parts of New Mexico, and plaster of paris mixed to a thin paste with water was found to be well adapted for use with pine-tar oil, safrole, and some crystalline organic acids. The baits were allowed to harden in cups of waxed paper, and the cup was suspended in a jar, of the type used for syrup baits, containing water to just below the bottom of the cup. During very rainy weather the cups were hung upside down or the jars fitted with a special cover. If yeast was used, it was added to a mixture of sawdust and syrup solution, which was covered with plaster of paris mixed with the same solution.

Although none of the attractants was consistently better than a liquid bait of fermenting cane syrup, safrole, phenyl acetic acid, pyruvic acid and yeast appeared promising. Those containing attractants of the essential-oil and organic-acid types were selective, attracting very few insects other than *C. pomonella*. Other advantages of the solid baits are that they can be prepared in advance of the flight period, can be protected from rain and are not adversely affected by excessively high temperatures, and the jars remain cleaner.

MICHELBACHER (A. E.). **Control of Codling Moth on Walnuts: Progress Report.**—*J. econ. Ent.* **38** no. 3 pp. 347–355, 8 figs., 7 refs. Menasha, Wis., 1945.

Cydia (*Carpocapsa*) *pomonella*, L., is the most important pest of walnuts in northern California, and bait-pan records have shown that there are two generations in the year. The larvae of the first began to enter the nuts early in May, and infestation increased very rapidly; they usually entered the nuts at the blossom end, and most of the infested nuts dropped or dried up on the tree. The larvae of the second generation began to enter the nuts in July, usually through the side or stem end. Some evidence was obtained that larvae of the first generation facilitate the entry of the causal organism of bacterial blight [*Pseudomonas juglandis*] of walnuts, but none that bacterial blight favours infestation by this generation. In the case of the second generation, there was considerable evidence that larvae enter nuts injured by blight or mechanical means more freely than they do normal nuts, of which the hardening husks and shells offer some resistance.

Investigations carried out in 1942–44 indicated that two spray applications give the best control. The first should be applied as near the beginning of May as possible to prevent damage by the first generation, but the second can be applied at any time between 18th May and 25th June, before the second-generation larvae hatch. A spray of 3 lb. standard lead arsenate, 1 lb. of a commercial basic zinc-sulphate safener (50 per cent. Zn) and ½ U.S. gal. neutral medium soluble oil per 100 U.S. gals., was more effective than one of 4 lb. basic lead arsenate and ½ U.S. gal. neutral medium soluble oil per 100 U.S. gals., and was used for two years without causing visible injury to the trees; further investigation is required before it can be recommended for general use. In 1944, a spray containing 1 lb. DDT per 100 U.S. gals. water with a wetting agent was applied on 9th May and again to half the trees on 26th June. Only 0·9 per cent. of the nuts in the harvested crop were infested after one treatment, and none after two, as compared with 18·63 per cent. for no treatment. The DDT sprays also killed the walnut Aphid [*Chromaphis juglandicola*, Kalt.] and its predators; the Aphid re-established itself and increased to rather destructive numbers before control by predators was resumed, but it is suggested that nicotine dust should be used against it if necessary.

HOFFMANN (C. H.). **Insect Pests of cultivated Goldenrod.**—*J. econ. Ent.* **38** no. 3 pp. 355–358. Menasha, Wis., 1945.

Records are given of the insects found attacking *Solidago leavenworthii* planted to produce a supply of rubber for technical experiment in Georgia, South Carolina, Mississippi, Alabama and Louisiana, showing the parts of the plant they attacked and the parasites associated with them. The pests included some polyphagous insects, but the identity of many of the species could not be determined, and their economic importance was doubtful; attempts to rear some of them were unsuccessful because they were heavily parasitised.

Turner (N.). **The Coverage Factor in the Application of Dusts.**—*J. econ. Ent.* **38** no. 3 pp. 359–364, 3 figs., 16 refs. Menasha, Wis., 1945.

An insect may survive a dust treatment either because the concentration of insecticide in the dust is inadequate or because the dust does not reach it at all, and it is necessary to consider coverage in deciding whether it is better to reduce the quantity of insecticide used by lowering the amount of mixture applied per acre or by lowering the concentration of insecticide in the mixture. Coverage may be affected by the amount applied per unit area, the electrostatic charge, the number, type and arrangement of nozzles used, the volume of air, the speed of air movement and the ground speed of the machine. Of these, the concentration of insecticide and the amount of dust applied per acre were studied in the field in Connecticut in 1942–44 with dusts containing derris or cryolite against cabbage caterpillars and the Mexican bean beetle [*Epilachna varivestis*, Muls.]. The former affected coverage because variations in amount of diluent affected the electrostatic charge developed in the process of applying the dust, but the latter had little or no effect on coverage within the limits tested (10–80 lb. per acre). The results showed that small amounts of dusts at higher concentrations were more effective than large amounts at a low concentration.

Vegetable Weevil in Oklahoma.—*J. econ. Ent.* **38** no. 3 p. 364. Menasha, Wis., 1945.

Adults of *Listroderes obliquus*, Gylh., were found in two localities in north-central Oklahoma in May 1945, the only plants injured in the gardens examined being tomatos. Since infestations have previously been reported only from States to the south and east of Oklahoma, it is assumed that the weevil is widespread there.

Eckert (J. E.). **The Effect of DDT on Honeybees.**—*J. econ. Ent.* **38** no. 3 pp. 369–374, 1 fig., 4 refs. Menasha, Wis., 1945.

In the experiments described, honey bees confined in a cage that had been sprayed on the inside with a 2 per cent. solution of DDT in kerosene and fed with sugar syrup all died within 12 hours at each trial for the first three months after spraying. Almost all of those exposed after five months died in 24 hours, but 50 per cent. died in 24 hours, and only four of those exposed after seven survived for over a week. Caged bees dusted with 2 and 3 per cent. DDT were all dead in less than 15 hours, and 50 per cent. of those dusted with 1 per cent. DDT died in 24 hours, though the remainder were still alive after a week. Additional bees put in the first two cages after the dead ones were removed remained normally active. Dusting bees in hives with 2 and 3 per cent. DDT caused some mortality, but did not permanently injure the colonies, and a 20 per cent. dust caused considerable mortality soon after application, but none more than 48 hours later. Queen-cage candy containing 1, 2 and 4 per cent. DDT killed all bees within 12 hours, and candy containing 0·1 and 0·01 per cent. DDT did so in 48 hours. Pollen pastes containing 0·23 and 0·98 per cent. DDT caused no obvious injury, but sugar syrup containing a small amount of DDT was toxic whether freshly mixed or two months old. When caged bees received only sugar syrup containing DDT for periods of three days, the median lethal dose was contained in a concentration of 13·7 micrograms DDT per cc. Data secured by feeding individual bees with known amounts of DDT in sugar syrup indicated that the median lethal dose was 4·6 micrograms DDT per bee.

HOFFMANN (C. H.). **An unusual Outbreak of Aphids on Pine.**—*J. econ. Ent.* **38** no. 3 pp. 375–377, 4 refs. Menasha, Wis., 1945.

During the winter of 1943–44 and the ensuing spring, large numbers of Aphids belonging to several species of *Cinara* were found on pines in North and South Carolina and Virginia. In South Carolina, *C. carolina*, Tissot, had been taken on *Pinus caribaea* in June 1939, when the ant, *Dorymyrmex pyramicus*, Roger, and a predacious species of *Leucopis* were associated with it. In January–March 1944, an undetermined species was found on *P. echinata* and *P. rigida*, *C. pini*, L., and *C. carolina* on *P. virginiana*, and *C. strobi*, Fitch, on *P. strobus*. The infestation was much reduced by the end of March, probably owing largely to parasitism by insects. In North Carolina, *Cinara* sp., *C. carolina* and *C. pini* were found on *P. echinata*, and the first two on *P. virginiana* in late February and March. Parasitism was evident in April and *Aphidius procephali*, Ashm., an undescribed species of the same genus and *Charips* sp. were reared from the Aphids. Syrphid larvae of the genus *Metasyrphus* were predacious on *Cinara* sp. It was reported from Virginia that pine Aphids, chiefly *C. taedae*, Tissot, with small numbers of *C. carolina*, were relatively abundant on *P. virginiana* during March 1944. There was no indication that the condition known as little-leaf disease of pine is intimately associated with these Aphids.

YOUNG (M. T.), SMITH (G. L.), GARRISON (G. L.) & GAINES (R. C.). **Effect of Nicotine applied with Calcium Arsenate at different Times of Day upon Cotton Aphids and Yields.**—*J. econ. Ent.* **38** no. 3 pp. 383–384, 3 refs. Menasha, Wis., 1945.

Increases of *Aphis gossypii*, Glov., on cotton dusted with calcium arsenate for the control of *Anthonomus grandis*, Boh., can be prevented by including nicotine in the dust, and the results are here given of experiments in Louisiana in 1941–44 to ascertain whether the time of day at which the mixture is applied has any effect on the control of the Aphid and the yield of cotton [*cf. R.A.E.*, A **32** 275]. Dusts of calcium arsenate with 0·5–2 per cent. nicotine as nicotine sulphate were applied in various schedules between daybreak and 8 a.m., and between 6 p.m. and dark and in one year between 1 p.m. and 3 p.m., and dusts of calcium arsenate alone were also applied. The results varied greatly, but the numbers of Aphids per sq. in. throughout the season and the yields of seed cotton per acre averaged 9·1 and 1,977 lb. for early-morning applications of the mixed dusts and 5·4 and 2,102 lb. for late-afternoon applications, as compared with 17·3 and 1,816 lb. for calcium arsenate alone and 6·4 and 1,790 lb. for no treatment. The minimum significant differences were 4 and 182 lb., respectively. Mid-day applications of the mixed dust gave no appreciable control of Aphids or increase in yield as compared with calcium arsenate alone, and the addition of nicotine to calcium arsenate did not significantly affect control of the weevil.

DICKE (R. J.), DEXHEIMER (F. J.) & ALLEN (T. C.). **Sabadilla Dust to control the Squash Bug.**—*J. econ. Ent.* **38** no. 3 p. 389. Menasha, Wis., 1945.

Preliminary tests in Wisconsin in which squash plants heavily infested with *Anasa tristis*, Deg., were dusted with sabadilla [*Schoenocaulon*] and covered with screens for 72 hours to prevent the escape of the insects showed that a 10 per cent. dust considerably reduced the numbers of adults and nymphs, and laboratory tests were therefore carried out to compare the effectiveness of sabadilla (2·7 per cent. alkaloids) and pyrethrum (0·5 per cent. pyrethrins), both mixed in various concentrations with pyrophyllite (Pyrax). Adults collected in the field were caged and exposed to the dust for two minutes and

were then transferred to clean cages and supplied with small pieces of squash. Dusts containing 5, 10, 15, 20, 25 and 30 per cent. sabadilla gave 20·4, 45·6, 60, 73·3, 90·2 and 96 per cent. mortality, as compared with 1·1 per cent. for no treatment, and dusts containing 12·5, 25, 37·5, 50, 62·5 and 75 per cent. pyrethrum gave 4·8, 12·5, 15·2, 16, 16·8 and 20·8 per cent. mortality, as compared with 0·9 per cent. for no treatment.

ALLEN (T. C.), DEXHEIMER (F. J.) & COLE (E.). **Reduction of certain Insects infesting Alfalfa by Use of Sabadilla.**—*J. econ. Ent.* **38** no. 3 pp. 389–390, 3 refs. Menasha, Wis., 1945.

Sabadilla dusts prepared by milling the seeds of *Schoenocaulon officinale* with lime and diluting them to contain 20 per cent. each of sabadilla and lime and 60 per cent. pyrophyllite (Pyrax) or 10 per cent. each of sabadilla and lime and 80 per cent. sulphur were compared with a dust of pyrethrum, talc and sulphur (0·15 per cent. pyrethrins) in field-plot tests carried out in Wisconsin in 1944 for the control of insects attacking lucerne. As compared with untreated lucerne, the numbers of the potato leafhopper [*Empoasca fabae*, Harr.], the tarnished plant bug [*Lygus oblineatus*, Say] and the red-legged grasshopper [*Melanoplus femur-rubrum*, Deg.] were 90·61, 97·62 and 97·62 per cent. smaller 12 hours after treatment with the first sabadilla dust, 61·4, 95·65 and 98·29 per cent. smaller after 36 hours, and 16.9, 80·9 and 92·32 per cent. smaller after 72 hours; after five days there were no differences in infestation by *Empoasca* and *Lygus* on treated and untreated plots, but 75·67 per cent. fewer grasshoppers on the treated ones. The corresponding percentages for the second sabadilla dust were 95·4, 93·7 and 97·7 after 12 hours, 72·6, 92·3 and 91·9 after 36, and 74·7, 69·3 and 70 after 72, and those for the pyrethrum dust were 89·4, 50 and 33·8 after 12 hours, 69·3, 15·3 and 18·1 after 36 and 67, 38·4 and 22·5 after 72. The average green weight and number of blossoms per 100 plants were 835 gm. and 417 for two applications of the first sabadilla dust, as compared with 753 gm. and 59 for no treatment, in the first cutting, and 321·2 gm. and 326 for four applications, as compared with 147·3 gm. and 15 for no treatment, in the second.

TATE (H. D.) & GATES (D. R.). **Toxicity of Sabadilla to Chinch Bugs and Squash Bugs.**—*J. econ. Ent.* **38** no. 3 p. 391. Menasha, Wis., 1945.

The results are given of laboratory and field tests in Nebraska on the control of *Blissus leucopterus*, Say, and *Anasa tristis*, Deg., with dusts and sprays containing sabadilla [*Schoenocaulon*]. A proprietary powder containing 20 per cent. each of the ground seed and lime and 60 per cent. talc was diluted with pyrophyllite (Pyrax ABB) for dusting or added to water for spraying. When the first generation of *B. leucopterus* was migrating from small grains to maize and most examples were still in the nymphal stage, small plots of heavily infested grass were surrounded by barriers, treated with a dust containing 10 per cent. sabadilla and kept under observation for five days. Practically complete mortality was obtained, and none of 1,000 individuals collected three hours after treatment recovered within a period of four days. In laboratory tests in which nymphs and adults of the second generation were dusted with 1, 3, 5 or 10 per cent. sabadilla or sprayed with concentrations of ½, 1 and 2 lb. powder per 100 U.S. gals., the dusts gave 25·7, 80, 98 and 98·7 per cent. mortality, respectively, in 2 days, as compared with 2·1 per cent. in the control, and the sprays 45·6, 65·4 and 99·4 per cent., as compared with 3·9 per cent.

In laboratory tests against nymphs and adults of *A. tristis* with dusts of 5 and 10 per cent. sabadilla and sprays containing 2 and 4 lb. powder per 100 U.S. gals., the dusts gave 85 and 96 per cent. mortality, respectively, and the

sprays 90 and 99 per cent., as compared with less than 2 per cent. in the controls. Lower concentrations were effective against nymphs in the early instars, but not against those in the late instars or the adults. Field tests on plots of squash gave less conclusive results, as it was difficult to obtain good coverage, but indicated that satisfactory control could be obtained by thorough applications of either dusts or sprays.

The immediate effect of the dust on both insects was hyperexcitation, which was followed by decreased activity. Most of them showed only feeble motion after two hours, but this continued for up to five days in some individuals.

It is concluded that sabadilla may have a practical use in protecting valuable experimental material or seed crops from *B. leucopterus* and in destroying bugs that have collected in large numbers on the outer rows of a field of maize at the time of migration from small grain, and that it is also promising for the control of *A. tristis*. Neither the dusts nor the sprays caused any injury to the plants.

BRUNN (L. K.) & ALLEN (T. C.). **Effectiveness of Sabadilla in Control of Cabbage Worms.**—*J. econ. Ent.* **38** no. 3 p. 392. Menasha, Wis., 1945.

Preliminary field tests in Wisconsin in 1943 having shown that dusts of sabadilla [*Schoenocaulon*] were toxic to larvae of *Pieris rapae*, L., and *Plusia* (*Autographa*) *brassicae*, Ril., sprays and dusts of rotenone, arsenates and sabadilla were applied to cabbage in 1944 to compare their effectiveness against these insects. The average numbers of larvae of *Pieris* per plant 24 hours after treatment were 0·38, 1·08, 0·23 and 0·45 after dusting with 0·5 per cent. rotenone, 20 per cent. calcium arsenate, and 20 and 10 per cent. sabadilla, respectively, and 0·1, 0·4, 0·67 and 1·13 after spraying with 4 lb. cubé, 4 lb. lead arsenate, and 8 and 4 lb. sabadilla per 100 U.S. gals., as compared with 5·22 for no treatment. The corresponding numbers of *Plusia* were 1·27, 0·72, 0·22 and 0·77 for the dusts, 0·71, 1·41, 1·11 and 2·55 for the sprays, and 4·65 for no treatment.

Since sabadilla compared quite favourably with rotenone in both dusts and sprays, it is considered a possible substitute for rotenone or pyrethrum against these insects.

FISHER (E. H.) & ALLEN (T. C.): **Control of Potato Leafhoppers infesting String Beans.**—*J. econ. Ent.* **38** no. 3 pp. 392–393. Menasha, Wis., 1945.

In field-plot tests carried out in Wisconsin in 1944 with various dusts for the control of *Empoasca fabae*, Harr., on string beans, the average percentage reductions of adults 24 and 72 hours after treatment, as compared with populations on the same plants 12 hours before treatment and on other plants 72 hours after it, were, respectively, 97·8 and 93·8 for a dust of 10 per cent. each of sabadilla [*Schoenocaulon*] and lime with 80 per cent. sulphur, 88·9 and 87·5 for the same dust with talc instead of sulphur, 92·1 and 85 for 1 per cent. dinitro-o-cyclohexylphenol, 88·6 and 75 for pyrethrum (0·02 per cent. pyrethrins and 0·5 per cent. of a synergist), and 76·1 and 62·5 for Lethane B71 (14 per cent. aliphatic thiocyanate). The corresponding percentage reductions of nymphs were 96·4 and 97·6 for sabadilla with sulphur, 95 and 87·8 for sabadilla with talc, 94·5 and 96·6 for dinitro-o-cyclohexylphenol, 92 and 79·3 for pyrethrum, and 81·3 and 64·8 for Lethane. It was concluded that sabadilla dust is effective over a period of 72 hours and that the addition of sulphur increased its toxicity throughout this period. It was subsequently used commercially against *E. fabae* on beans and insect pests of cranberry.

ALLEN (H. W.) & BRUNSON (M. H.). **A Microsporidian in** *Macrocentrus ancylivorus*.—*J. econ. Ent.* **38** no. 3 p. 393. Menasha, Wis., 1945.

During a study of the rearing of *Macrocentrus ancylivorus*, Rohw., on *Gnorimoschema operculella*, Zell., in the summer of 1944, many of the adult parasites were observed to have conspicuous whitish areas in the abdomen. These were found to be due to the presence of an organism that appeared to be a microsporidian, which is described. Many infected adults had swollen abdomens, and some were almost unable to fly. Infected males and females lived half and three-quarters as long, respectively, as healthy ones; they reproduced, but 29 infected females gave rise to only 182 young, as compared with 498 for 29 healthy females. The prevalence of the organism is probably not correlated with its presence in the parent parasites, since 39 per cent. of 117 adults from diseased parents and 40 per cent. of 333 from healthy parents were diseased. The ratio of females to males was as high in the progeny of infected females as in the progeny of healthy ones.

FLANDERS (S. E.). **Mass Production of** *Trichogramma* **using Eggs of Potato Tuber Worm.**—*J. econ. Ent.* **38** no. 3 pp. 394–395, 4 refs. Menasha, Wis., 1945.

The recent discovery that *Gnorimoschema operculella*, Zell., can be reared in enormous numbers [*cf. R.A.E.*, A **32** 367] and forced to deposit its eggs uniformly over a sheet of cloth or paper [**33** 219] has increased the possibility of rearing *Trichogramma* in numbers sufficient to inundate areas infested with its hosts; this method of control offers greater hope of success than relying on the accretion of the progeny of small numbers [*cf.* **19** 97]. Adults of *Trichogramma* reared from *Gnorimoschema* eggs are more robust than those reared from eggs of *Sitotroga* [*cerealella*, Ol.].

The cloth or paper on which the eggs are to be laid is thoroughly wetted and then put on top of a wire-netting cage containing the ovipositing moths [*cf.* **33** 219]. The egg sheets are removed daily and placed for parasitism in wooden boxes or cells stacked in front of a large window. The end of each cell facing the window is glazed and the other is open and unlighted. Each cell contains a thin rigid plate 15 inches square, standing on four short pegs so that it can be removed and replaced with little injury to parasites on the floor of the cell and with just enough clearance between the plate and the top of the cell to take the egg sheets. The heads of several brads placed on the edges of the plate allow the parasites to move about the cell freely when the plate is in position against the glass end. The egg sheets are cut to one third the size of the plate, and each plate bears a sheet of fresh eggs at the window end, one of eggs parasitised during the preceding 24 hours at the other, and portions of egg sheets from which enough parasites are emerging to parasitise the fresh eggs between them. Each day the sheet of eggs parasitised two days previously is replaced by a sheet of fresh eggs and the plate is reversed in the cell. If the relative humidity is kept at about 60 per cent., the parasites can be fed with undiluted honey put in hair-line streaks on strips of waxed paper.

CORY (E. N.). **Control of several Scales infesting Orchids.**—*J. econ. Ent.* **38** no. 3 p. 395. Menasha, Wis., 1945.

Several insecticides other than DDT have been tested in Maryland since 1939, but none of them has been completely satisfactory. In 1944, a mixture of 20 parts DDT dissolved in 60 parts xylol to which 20 parts Triton was added as the emulsifier (Federal formula) was dispersed in water at the rate of 20 cc. per U.S. quart to give 0·022 per cent. actual DDT, and applied with an atomiser until the plants were completely covered with fine droplets and some surplus

was running down the stems into the crowns. Four applications at intervals of approximately three weeks gave complete control for at least four months of *Lepidosaphes machili*, Mask. (*tuberculatus*, Malen.), *Chrysomphalus dictyospermi*, Morg., and *Coccus pseudohesperidum*, Ckll., on *Cymbidium* and of the last named on *Epidendrum*; of *Pseudoparlatoria parlatorioides*, Comst., and *Parlatoria proteus*, Curt., on *Cypripedium*; of *Diaspis boisduvali*, Sign., on *Cattleya*, *Epidendrum* and *Oncidium*; and of *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.) and *Coccus hesperidum*, L., on *Dendrobium*, *Phalaenopsis*, *Vanda*, *Oncidium*, *Calanthe* and *Cyrtopodium*. The only plant damage was a more rapid yellowing of leaves that were apparently mature and would soon have dropped. A single application gave complete control of *S. coffeae* on maidenhair fern [*Adiantum*], with slight damage to the plant. Plants in commercial houses, particularly those 6–18 months old in community pots, showed remarkable improvement in growth in two weeks when sprayed with 0·4 per cent. DDT.

MARCOVITCH (S.). **A Calcium Cyanamid-Sodium Fluosilicate Mixture for Use as a Defoliant.**—*J. econ. Ent.* **38** no. 3 pp. 395–396. Menasha, Wis., 1945.

The author states that calcium cyanamide has proved of value for defoliating cotton in the United States, and that the reaction with water that releases the toxic material takes place more quickly if sodium fluosilicate is added. A dust of calcium cyanamide, sodium fluosilicate and pyrophyllite (25 : 25 : 50) and a spray of 4 lb. each of calcium cyanamide and sodium fluosilicate in 50 U.S. gals. water were effective, and it is suggested that since sodium fluosilicate has insecticidal properties, its use would have the additional advantage of destroying the boll weevil [*Anthonomus grandis*, Boh.] and the pink bollworm [*Platyedra gossypiella*, Saund.].

WELLINGTON (W. G.). **Gelatin Capsules used in Studies of Insect Parasites.**—*J. econ. Ent.* **38** no. 3 p. 396. Menasha, Wis., 1945.

The author gives examples of the use of transparent gelatine capsules to provide a means of studying the oviposition and development of insect parasites that normally deposit eggs beneath an opaque surface. It was found possible to observe the oviposition of *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.), an external parasite that develops within the host cocoon, by substituting a capsule, which contained a host individual and was pierced at some point to permit the passage of the ovipositor, for the cocoon, and to observe development of the larvae on the host through a microscope without disturbing the contents of the capsule, but it was necessary to liberate newly emerged adults. To study the stimuli that induce oviposition by *Apanteles carpatus*, Say, an internal parasite of the case-making clothes moth [*Tinea pellionella*, L.], small portions of the walls of empty capsules were replaced by larval silk, frass or skin. Only one egg was obtained, but it is considered that eggs of an internal parasite could readily be obtained for description or for transplantation experiments if a gelatinous substance were placed under the attractant.

GILMORE (J. U.) & LEVIN (C.). **Fuel Oil as a Larvicide for the Tobacco Flea Beetle.**—*J. econ. Ent.* **38** no. 3 pp. 397–398, 5 refs. Menasha, Wis., 1945.

Experiments in North Carolina have shown that the destruction by cultural methods of the tobacco plants left in plant beds after transplanting greatly reduces the numbers of larvae of *Epitrix hirtipennis*, Melsh., that subsequently complete their development in the soil [*R.A.E.*, A **32** 359]. The value of destroying the larvae by insecticides was tested in 1942; they were applied

late in May, after the plants left in the beds had been cut low with a weed killer, and cages placed on the soil to catch the beetles that emerged were examined at frequent intervals for a month. The treatments comprised fuel oil and petrol, each applied with a watering can at the rate of 16 fl. oz. per sq. yard, and paradichlorbenzene broadcast at 8 oz. per sq. yard, and they reduced the average numbers of beetles that emerged per sq. foot of soil to 0·5, 45·7 and 29·2, respectively, as compared with 1,011·5 from untreated soil. In continued experiments in June 1943, 16, 11 and 5 fl. oz. fuel oil per sq. yard reduced the average numbers by 98, 94 and 89 per cent., respectively. For the lower dosages the oil was mixed with enough water to make 16 fl. oz. per sq. yard by agitation with a small force pump. The lowest dosage was as effective as the best cultural treatment [*cf. loc. cit.*].

To determine whether fuel oil would harm crops planted on treated ground, the soil was loosened with a trowel 30 days after treatment in 1943 and planted with maize, snap bean, soy bean, wheat and cowpea. Examination three weeks later showed no effect on the germination and subsequent growth of maize, soy bean, wheat and cowpea. The germination of snap bean and wheat appeared to be slightly affected, but their growth compared favourably with that in untreated plots.

LATTA (R.). **Christmas Tree Quality improved by Methyl Bromide Fumigation.**—*J. econ. Ent.* **38** no. 3 p. 398. Menasha, Wis., 1945.

To test the effect on cut fir [*Abies*] and spruce, intended for use as Christmas trees, of fumigating them with methyl bromide under the provisions of a quarantine [*R.A.E.*, A **33** 145], trees from commercial stocks were fumigated with dosages of 2½–3 lb. per 1,000 cu. ft. for 2½–8 hours at temperatures of over 32°F. and then kept under observation at about 80°F. for 19–39 days. The fumigated trees, particularly the firs, kept their needles and colour longer than untreated ones, and those that had been subjected to high dosages or long exposures were in the best condition at the end of the observation period. Similar results were obtained with trees that had been exposed to a dosage of 2½ lb. for 6–24 hours in the course of routine quarantine treatment.

BRANNON (L. W.). **Cryolite and some organic Compounds to control Corn Earworm and the Mexican Bean Beetle.**—*J. econ. Ent.* **38** no. 3 p. 400, 2 refs. Menasha, Wis., 1945.

The results are given of experiments in Virginia in 1942 in which dusts and sprays were applied on 10th, 12th and 30th September to heavily infested bush lima beans for the control of *Heliothis armigera*, Hb., and *Epilachna varivestis*, Muls. The first application was made when the first pods were setting, but its value was greatly reduced by heavy rain nine hours later. The percentages of the foliage injured by *Epilachna* three weeks after the third application and the numbers of pods injured by *Heliothis* and of marketable pods per plant at harvest were: 14, 58 and 381 for a dust of 10 per cent. micronised phenothiazine in talc with 1 per cent. sodium lauryl sulphate; 14, 35 and 437 for undiluted cryolite (83 per cent. sodium fluoaluminate); 3, 23 and 447 for 70 per cent. cryolite in talc; 22, 41 and 311 for 50 per cent. cryolite in talc with 2 per cent. of a thiocyanate (50 per cent. β-thiocyanoethyl esters of aliphatic acids); 2, 39 and 464 for a spray of 4 lb. phenothiazine and 2 oz. sodium lauryl sulphate per 50 U.S. gals. water; 8, 41 and 421 for a spray of 4 lb. cryolite per 50 U.S. gals.; and 66, 51 and 217 for no treatment. A dust containing 15 per cent. of a calcium salt of dinitro-o-cyclohexylphenol gave some protection against *Heliothis* but was ineffective against *Epilachna*, and one of 10 per cent. xanthone with 1 per cent. sodium lauryl sulphate controlled neither insect and caused some injury to the foliage.

FROST (S. W.). **Strange Oviposition Habits of a Treehopper.**—*J. econ. Ent.* **38** no. 3 p. 403, 1 fig., 3 refs. Menasha, Wis., 1945.

Apple fruits received in the autumn of 1944 from a commercial orchard in Pennsylvania that was free from clover, lucerne and weeds showed oviposition scars of a treehopper of the genus *Ceresa* or *Sterictophora* [*sic* ? *Stictocephala*]. These Membracids normally oviposit in two- or three-year-old twigs, though they may use succulent plants, and it seems unlikely that eggs deposited in fruits would develop, since the fruits would rot before the nymphs hatched in the following spring.

BRANNON (L. W.). **Insecticidal Tests for Control of Green Clover Worm and *Autographa* on Snap Beans.**—*J. econ. Ent.* **38** no. 3 pp. 403–404, 1 fig., 3 refs. Menasha, Wis., 1945.

In the autumn of 1942, severe outbreaks of *Plathypena scabra*, F., and *Autographa* sp. occurred in many fields of snap beans, lima beans and soy beans in eastern Virginia, and experiments were carried out to determine the effectiveness against them of cryolite, which was already being applied in some fields for the control of *Heliothis armigera*, Hb., and other dusts. A single application was made to snap beans on 11th September, when the plants were just beginning to bloom. Cryolite and talc (70 per cent. sodium fluoaluminate) and undiluted cryolite (83 per cent. sodium fluoaluminate) reduced the numbers of living larvae present 72 hours after treatment by 86 and 92 per cent. and gave good protection of foliage. Pyrethrum and sulphur (0·5 per cent. pyrethrins) reduced the number of larvae by 90 per cent., but did not protect the foliage so well. The other dusts tested, which were much less effective, were pure sulphur, a mixture of cryolite, thiocyanate and talc containing 50 per cent. sodium fluoaluminate and 2 per cent. thiocyanate, derris and talc (0·75 per cent. rotenone), derris, pyrethrum and talc (0·2 per cent. rotenone and 0·1 per cent. pyrethrins) and 10 per cent. xanthone in talc. It is suggested that a mixture of sulphur to control powdery mildew [*Erysiphe polygoni*] and cryolite to control these Noctuids and also *H. armigera* and *Epilachna varivestis*, Muls. [*cf. R.A.E.*, A **34** 138] may be of value on autumn beans in this area.

BRANNON (L. W.). **Biology and Control of the Lima Bean Vine Borer.**—*J. econ. Ent.* **38** no. 3 pp. 407–408, 1 fig., 2 refs. Menasha, Wis., 1945.

Investigations on *Monoptilota pergratialis*, Hulst (*nubilella*, Hulst) on lima beans in Virginia in 1936–42 showed that this Pyralid has two generations in the year. Oviposition by the overwintered generation begins during the second half of May, and the eggs are laid singly on the leaf or stem and hatch in 2–6 days. The larvae feed on the leaves for 4–7 days and then bore into the stems, where they cause the formation of galls. When full-fed, they leave the galls, drop to the ground and spin cocoons in which to pupate. The pupal stage lasts about 15 days, and the first-generation adults emerge during the second half of July and begin to oviposit within 24 hours. Larvae of the second generation become full-fed in September and October, overwinter in cocoons on or near the soil surface and pupate during the first part of May. The adults emerge from about mid-May to mid-June.

The galls cause little damage if they are on the main stem, unless two larvae are present in one gall or one is formed just above another, but may result in wilting and dying of the plant above them if they are formed at the junction of the main stem and a branch or on a small branch near the tip; plants weakened by galls are easily broken by the wind. The borer appears to prefer a large-seeded variety of lima bean to a small-seeded one, apparently owing to the larger stem of the former.

In experiments on control of the larvae before they enter the stems, a dust of cryolite and sulphur (70 per cent. sodium fluoaluminate) and a spray of 3·8 lb. cryolite (89 per cent. sodium fluoaluminate) and 2 lb. wettable sulphur in 50 U.S. gals. water, applied on 6th, 13th and 25th June and 9th July, the first treatment two days before the hatching of the first eggs and the last 19 days before the first picking, gave about 68 and 52 per cent. control, respectively. Autumn ploughing and cultivation are suggested to destroy the overwintering larvae.

MORRISON (H. E.), MOTE (D. C.) & LUNDE (R. N.). **The Use of a "Rototiller" for Application of Soil Fumigants.**—*J. econ. Ent.* **38** no. 3 p. 409. Menasha, Wis., 1945.

In the course of investigations on the control of *Scutigerella immaculata*, Newp., in Oregon, in which the most promising results were obtained with partial soil sterilising agents, a "rototiller" was equipped with a small petrol motor and air compressor to atomise fumigants into the soil immediately behind the rototiller tines. Its use resulted in the preparation of the seedbed by ploughing, disking, harrowing and soil sterilisation in one operation.

Preliminary tests indicated that by this method the amount of partial soil sterilising agents may be reduced by 50 per cent. and still give satisfactory control. Rototilling of soil without the addition of soil sterilising agents has made it possible to raise normal crops in heavily infested soils, probably because although there was no reduction in the total *Scutigerella* population, the individuals were thoroughly scattered and could not establish themselves about the roots of the germinating plants, which were therefore able to develop good root systems and withstand later attack.

ESSIG (E. O.). **A Synonym of *Cerosipha subterranea* (Mason).**—*J. econ. Ent.* **38** no. 3 p. 409, 2 refs. Menasha, Wis., 1945.

The author states that *Cerosipha californica*, Essig, described from guayule [*Parthenium argentatum*] in California [*R.A.E.*, A **34** 149], is identical with *Rhopalosiphum subterraneum*, Mason, which is tentatively referred to the genus *Cerosipha*. The distribution and food-plants for this Aphid are briefly reviewed.

MORRISON (H. E.), MOTE (D. C.) & RASMUSSEN (W. B.). **DDT to control *Scutigerella immaculata*.**—*J. econ. Ent.* **38** no. 3 p. 410. Menasha, Wis., 1945.

When bean seeds were mixed with 3 per cent. DDT (5 : 4 by weight) before being planted in ground heavily infested with *Scutigerella immaculata*, Newp., in tests carried out in Oregon in 1944, the normal yield of 15 bushels per acre was obtained for the first time for 15 years. The rate of application of DDT was calculated as approximately 90 lb. per acre. Population counts showed a reduction from 45·2 to 1·6 examples of *S. immaculata* per sq. ft. Small-scale tests with DDT indicated that about three hours was required for complete mortality. When 3 per cent. DDT was broadcast and tilled into the soil at rates of 145, 220 and 366 lb. per acre, there was no apparent reduction in the *Scutigerella* population. There was no evidence of injury to the plants developing from treated seed, although germination was retarded by about two days.

APPLE (J. W.). **DDT to control Cabbage Caterpillars.**—*J. econ. Ent.* **38** no. 3 p. 410, 3 refs. Menasha, Wis., 1945.

The results are given of experiments in Illinois in 1944 on the use of DDT in dusts for the control of *Plusia* (*Autographa*) *brassicae*, Ril., *Pieris rapae*, L.,

and *Plutella maculipennis*, Curt., on cabbage. Infestation was light, with the first species predominating. Dusts were applied on 25th August and 2nd, 12th and 24th September, and the results were assessed on 9th October, according to the average amounts of leaf damage. Four applications of 3 per cent. DDT gave excellent control, but abundant rainfall and the rapid growth of the plants greatly reduced the residual effect of the dust; fewer applications gave progressively poorer results. In further tests in which four applications were made, a mechanically mixed dust containing 1 per cent. DDT was less effective, but gave satisfactory control under the conditions of the test, and dusts prepared by impregnating pyrophyllite (Pyrax) with DDT dissolved in acetone or Velsicol AR 60 [a preparation of methylnaphthalenes] to give 1 per cent. dusts gave very good control; this method of preparation is promising as a means of reducing the concentration of DDT while retaining a high level of toxicity.

Division of Entomology.—*Rep. Sci. Serv. Dom. Can. Dep. Agric. 1943–44* pp. 49–62. Ottawa [1945].

This is a survey of work carried out at the various experiment stations throughout Canada in 1943. In general, insects caused relatively little damage to crops, but infestation by the wheat stem sawfly [*Cephus cinctus*, Nort.] was the heaviest yet recorded and resulted in losses estimated at $20,000,000. It was most severe in south-western Saskatchewan, where crops were reduced by 75–80 per cent. in some fields, was also heavy over an area extending from eastern Saskatchewan to the foothills of the Rocky Mountains, and extended north almost to the park belt and south to the United States.

The results of studies on the movements of the four Aphids that attack potato in New Brunswick [*cf. R.A.E.*, A **31** 129] indicate that free migration takes place across Northumberland Strait to Prince Edward Island and possibly also in the reverse direction, and across the Bay of Fundy to Nova Scotia, and that mass movements commonly occur at different times during the summer up the St. John River and across the Province from the south-west to the north-east. Aphids were trapped in central New Brunswick on mountain peaks about 25 miles from the nearest potato fields. Sprays of nicotine sulphate or rotenone were the most promising of various dusts and sprays tested against the Aphids, but did not give complete control.

Investigations to discover suitable substitutes for insecticides that were scarce were carried out at Ottawa. Dusts of barium or sodium fluosilicate were as effective as the standard sprays and dusts against the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] when carefully mixed and applied. A dust containing 1 per cent. creosote in a clay carrier was the most satisfactory substitute for mercuric chloride (corrosive sublimate) against the cabbage maggot [*Hylemyia brassicae*, Bch.]; a mixture of mercurous chloride (calomel) and maize starch applied to the stems of transplants before setting out also gave outstanding results. In British Columbia, ovipositing females of the carrot rust fly [*Psila rosae*, F.] were effectively repelled by naphthalene flakes in carrot fields.

Much of the damage due to the strawberry weevil [*Anthonomus signatus*, Say] in New Brunswick is caused by adults that have overwintered in the plantations [*cf.* **31** 132], and the amount of injury was found to be closely correlated with the amount of snow cover in individual plantations. In British Columbia, two applications of 1 per cent. summer oil in Bordeaux mixture, made when the receptacles split and again two weeks later, successfully controlled the European red mite [*Paratetranychus pilosus*, C. & F.] on prunes and proved more effective than the standard dormant spray of oil emulsion; a summer oil with a viscosity of 45–55 Saybolt was as effective as the one with a viscosity of 75–85 hitherto recommended and was considerably cheaper.

The jack pine budworm [the form of *Harmologa fumiferana*, Clem., that attacks *Pinus banksiana* (*cf.* **32** 178)] appeared to be declining in numbers during 1941 and 1942, but infestation gradually increased in intensity and extent in 1943, especially in north-western Ontario, and severe defoliation occurred in some districts. The infested area extended almost to the western border of Ontario. A severe outbreak of the black-headed budworm [*Acleris* (*Peronea*) *variana*, Fern.] occurred over extensive areas along the Pacific coast, both on the mainland and on Vancouver Island, in which hemlock [*Tsuga*], balsam [*Abies balsamea*] and Douglas fir [*Pseudotsuga taxifolia*] were the trees most severely attacked; an examination of older infestations indicated that tree mortality may not be heavy. A similar outbreak was recorded on the Queen Charlotte Islands.

Of the parasites introduced against *Pyrausta nubilalis*, Hb., on maize, *Eulophus viridulus*, Thoms., and *Lydella stabulans* [var. *grisescens*, R.-D. (*Ceromasia senilis*, auct.)] extended their range in Ontario [*cf.* **31** 457; **33** 139], and *Macrocentrus gifuensis*, Ashm., continued to increase satisfactorily in southern Quebec. The last named was reared in the laboratory and liberated in Quebec and in Ontario.

The keeping of grain in temporary stores from which it could not easily be moved has been the cause of much of the insect infestation of stored grain that has occurred in recent years. In both 1942 and 1943, the rust-red grain beetle [*Laemophloeus ferrugineus*, Steph.] was the chief species involved. Infestation usually began in small localised patches and quickly spread to dry, sound grain. Attempts to fumigate restricted areas within the larger mass with chlorpicrin were unsuccessful, but carbon tetrachloride alone or mixed with chlorpicrin gave complete control. Railway waggons that had been used for the transport of grain and that were known to be infested were cleaned with compressed air. Several infestations by the rice weevil [*Calandra oryzae*, L.] and the granary weevil [*Calandra granaria*, L.] were reported in southern Manitoba during 1942 and 1943.

Papers noticed by Title only.

Wolcott (G. N.) & Martorell (L. F.). **Las posibilidades de combatir el barreno de la caña de azúcar, *Diatraea saccharalis* F., en Puerto Rico llevando a los cañaverales los parásitos *Trichogramma minutum* Riley criados en laboratorio.** [The Possibilities of controlling the Sugar Cane Borer, *D. saccharalis*, in Porto Rico by breeding the Parasite, *T. minutum*, in the Laboratory and releasing it in Cane Fields.]—*Bol. Estac. exper. agric. P. Rico* no. 64, 16 pp., 1 fig., 1 fldg. table. Río Piedras, P.R., 1943. (With a Summary in English.) [*Cf. R.A.E.*, A **32** 53; **33** 243.]

Starr (D. F.), Baker (E. W.) & Ramirez (J. A.). **A Dispenser for Methyl Bromide and Methyl Bromide-DDT Aerosols** [for laboratory use].—*J. econ. Ent.* **38** no. 3 pp. 401, 1 fig. Menasha, Wis., 1945.

Batt (G. H.) **New Sprayer for testing Aerosols.**—*Soap* **21** no. 7 p. 117, 119, 2 figs. New York, N.Y., 1945.

Stiff jr. (H. A.) & Castillo (J. C.). **The Determination of 2,2-bis (*p*-chlorophenyl)-1, 1, 1-trichloroethane (DDT) in Organs and Body Fluids** [of rabbits] **after oral Administration.**—*J. biol. Chem.* **159** no. 2 pp. 545-548, 3 refs. Baltimore, Md., 1945.